The Tropical Agriculturist

AND

Magazine of the Ceylon Agricultural Society.

FOUNDED BY JOHN FERGUSON, C.M.G., 1881.

EDITED BY

J. C. WILLIS. Sc.D., F.L.S.,

Director, Royal Botanic Gardens, Peradeniya.

Vol. XXVII.

Containing Numbers I to VI. : July to December, 1906.

32226

A. M. & J. FERGUSON,

COLOMBO, CEYLON.

1907.

THE CEYLON BOARD OF AGRICULTURE.

President:

HIS EXCELLENCY THE GOVERNOR.

Vice-Presidents:

The Hon'ble Mr. H. C. Nicolle, Colonial Treasurer
The Hon'ble Mr. John Ferguson, C.M.G.
The Hon'ble Mr. S. C. Obeyesekere
The Hon'ble Mr. Francis Beven
Sir William Twynam, K.C.M.G.
Mr H. T. S. Ward, Director of Irrigation
Mr. W. Forsythe
Mr. W. D. Gibbon
Mr. C. P. Hayley
Dr. W. G. Rockwood, M.D.

Members of the Board:

Ex-Officio.—Members of the Executive and Legislative Councils
The Government Agents of Provinces
The Director, Royal Botanic Gardens
The Controller, Experiment Station, Peradeniya
The Government Entomologist
The Government Mycologist
The Director of the Museum
The Director of Public Instruction
The Government Veterinary Surgeon
The Superintendent of School Gardens
The Conservator of Forests

Nominated Members:

Western Province.

Mr. R. Morison
" M. Kelway Bamber
" L. W. Booth, C.C.S.
" E. B. Denham, C.C.S.
" Solomon Seneviratne, Atapattu Mudaliyar and J.P.
" Don Solomon Dias Bandaranaike, C.M.G. Maha Mudaliyar.
Dr. H. M. Fernando, M.D.
Mr. W. N. S. Aserappa
" W. Jardine

Central Province.

Mr. R. E. Paranagama, R.M.
" Daniel Joseph
" W. Dunuwille, Disava
Dr. Valentine de S. Duke

Northern Province.

Mr. V. Casipillai
" V. Vraspillai, Adigar and J.P.
" K. U. Tampaiya, District Mudaliyar.

Southern Province.

Mr. C. G. Simmonds
" E. R. Gooneratne, Gate Mudaliyar
" D. A. Gooneratne, Gate Mudaliyar
" B. T. Doole, Gate Mudaliyar

Eastern Province.

Mr. Varitambi Kurunathapillai
" C. A. Lienard

North-Western Province.

Mr. E. Scott
" J. Clovis de Silva
" G. W Dodanwela
" S. N. W. Hulugalle, Adigar

North-Central Province.

Mr. C. J. C. Mee
" S. Sampander
" C. Valoopillai
" G. W. Jayawardene, Mudaliyar and J.P.
" C. Taldena, R.M.

Province of Uva.

Mr. A. T. Rettie
" James Duncan
" H. O. Hoseason, J.P.
" T. B. Katugaha, R.M.

Province of Sabaragamuwa.

Mr. W. Forsythe
" Dan. J. Jayatileke
" J. H. Meedeniya, R.M.

Secretary:

Mr. A. N. Galbraith, C.C.S.

281
T77

INDEX.

PAGE.

Editorials, Lectures, Original Articles, etc:—

Agricultural Banks for Ceylon ...268, 325
„ Society Progress Report, 116, 198, 351, 434, 437, 516
„ Societies, Use and Objects of ... 500
Agriculture, Possibilities of Improvement in Village 1, 119
Agri-Horticultural Show, Kegalle... 339
„ „ Kelani Valley 337
„ „ Kurunegala 335
Area under Rubber in Ceylon ... 121
Board of Agriculture, Ceylon 115, 197, 350, 433, 436, 513
Botany, Lessons in Elementary 97, 191, 277, 340, 413, 505
Brand Marks on Kandyan Cattle ... 253
Cacao, Cultivation in Ceylon, 73, 144, 311, 380, 480
Camphor Industry, Ceylon ... 475
Castilloa Elastica, Introduction to the East of 206
Coconut Germination of the ... 232
„ Cultivation of the ... 318
„ Diseases of the... ... 489
Cotton in Ceylon 231
Crushing of Cattle by the Kandyans 407
Dry Grains of Ceylon 486
Encouragement of Arts and Crafts in Ceylon 497
Entomological Notes 82, 193, 248, 394, 492
Improvement of Local Varieties of Plants 203
Irrigation in Arizona, Notes on .. 271, 323
Lemongrass and Citronella in Ceylon 140
Lessons in Elementary Botany 97, 191, 277, 340, 413, 505
Literature of Economic Botany and Agriculture... 98, 179, 276, 342, 422, 504
Market Gardening in Nuwara Eliya 88
Mycological Notes 86
Nature of the Para Rubber Tree and Latex Extraction 214
Poultry Notes... ... 95, 250, 406, 495
Rubber and Cotton in Ceylon .. 299
„ Cultivation and Manufacture, Notes on 22
„ Cultivation and the Future Production 442
„ Cultivation, The Science of 3
„ Exhibition, Ceylon ... 280
„ in London 367
„ Overproduction in .. 441
„ Preparation of Block ... 469
„ Price of 357
„ Shipment to London ... 358
„ Tapping Demonstration at Henaratgoda 460
„ Vulcanisation 281
Sanitation on Estates 506
Termes Gestroi, the Hevea Rubber Termite 85

PAGE.

Tobacco Cultivation in Jaffna ...245, 315
Village Agriculture, Possibilities of Improvement in 119

Gums, Resins, Saps and Exudations:—

Achres or Chicle Gum 229
Camphor Cultivation in Southern India 378
„ Ceylon Industry ... 475
„ Cultural Directions ... 34
„ Industry, 1905, The Chinese 377
Chicle Gum, Tapping and Preparing 229
Zapote Tree (*Achres sapota*) in Mexico 229

RUBBER :—

Castilloa Elastica:

Black Water of Castilloa ... 128
Coagulation of Latex by Chemicals 21
Cultivation in Nicaragua ... 17, 126
Fungi on Trees 86
Introduction to the East ... 206
Latex Coagulating 20
„ Manipulation of 19
„ Treatment after Coagulation 126
Nicaragua, Cultivation in ... 17, 126
Resin in Young Trees 128
Tapping Methods 17
Yields in Mexico 123
„ of Castilloa 128
Cultivation in Colombia ... 471
Guayule, Use of 457

Hevea Brasiliensis or Para :

Bark Renewal 467
„ Varieties of 12
Block Para, Preparation of ... 469
Canker Fungus 86
Caoutchouc in Brazil Rubber ... 281
„ in Latex, Proportions of 452
Characters of Hevea 443
Cultivation in Malay Peninsula ... 22
„ Science of 3
Disease, Spread of 5
Drying Rubber, Points in ... 24
Foliage, Development of ... 4
„ Effect of Increased ... 8
Forking, Effect of 6
Fungi on Rubber 86
Inter-crops *v.* Clean-weeding ... 8
Irrigation, Cultivation under ... 301
Latex, Chemical Composition of ... 281
„ Coagulation of 468
„ Effect of Removing .. 217
„ Extraction 214
„ from Seed 223
„ Manuring for 216
„ Trees without 226
„ Tubes Drying up... .. 216
„ without Rubber 461
Laticiferous Cells, Origin and Formation of 215

PAGE.
Manuring for Latex 216
„ Hevea Trees 449
Nature of Para Tree and Latex Extraction 214
Pest, White Ant 85
Planting Close, Advantages of .. 5
„ Distance in 3
Pruning Young Trees 6
Root Disease 10, 86
„ Growth 4
Rubber and Cotton, Ceylon ... 299
Seed, Exports from Malaya ... 129
„ Packing and Exporting ... 24
Tapping Demonstration at Henaratgoda 460
„ During Flowering Period 11
„ Frequency of 218, 466
„ High... ... .. 461, 465
Termes Gestroi, the Hevea Termite 85
Weeding Clean *v.* Inter-crops ... 8
Yields at Henaratgoda 462

General :—

Acid in Rubber Coagulation ... 209
Ammonia on Latex, Action of .. 291
Area in Ceylon under Cultivation... 121
Burgess on the Industry in Britain 131, 209, 292
Boom, The Rubber 213
Caoutchouc Contents of Brazil Rubber 281
„ Formation in Bark ... 215
Comparative Value of Plantation Rubbers 444
Consumption in America ... 137
Crêpe in London Market ... 33
„ Rubber 371
Cultivation and Future Production 442
Culture, Truth about Rubber ... 121
Dock Labourer and Rubber in London 363
Drying Rubber 210
Extracting Rubber, Methods of ... 445
Extraction, New Era in Rubber ... 135
Formalin on Latex, Action of .. 291
Grades of Rubber, Qualities of Different 367
Industrial Demand, The ... 29
Industry in Ceylon and America, Plantation 26
„ in Great Britain, Burgess on ... 131, 209, 292
In Malay Peninsula 27, 373
In Samoa 375
Land in the Tropics, Rubber .. 446
Latex, Action of Ammonia and Formalin on 291
„ Chemical Composition of .. 281
„ Sulphurising and Colouring 285
London, Rubber in 367
Malaya, Rubber in 27, 373
Manuring Rubber 449
Market, London Rubber.. 31, 137, 227, 304, 376, 471
Masticating Rubber 212
Mixing Rubber 213
Nerve in Rubber, Lack of .. 373
Olsson-Seffer on Rubber ... 121
Overproduction in Rubber ... 441
Physical Properties and Chemical Composition of Rubber, Relation of 364
Plantation Industry in Ceylon and America 26

PAGE.
Plantation Rubber, Preferred Forms of ... 369
„ „ Smoking ... 208
„ „ Supply ... 447
Price of Rubber 357
Pure Rubber, Value of Chemically 454
Ratnapura, Suitability for Rubber Growing of 225
Raw Rubber, Preparation of ... 209
Rubber Formation in Bark ... 215
„ in Malaya 27, 373
„ Samoa 375
„ Manufacture 292
Sabaragamuwa, Suitability for Rubber Growing of 225
Samoa, Rubber in 375
Sampling in London 361
Seed-bearing and Overtapping ... 224
„ Parents, Selection of .. 226
Separating Strong and Weak Rubber 363
Shipment to London 358
Smoking Plantation Rubber .. 208
Solution Making 293
Sulphurising Rubber in Ceylon ... 285
Tapping Methods 260, 345
Vulcanising Methods and Ingredients 282
Vulcanisation.. 281
Washing Raw Rubber .. 211
Yields in 1905, Comparison of Plantation 445
„ of Plantations, Future .. 448

Oils and Fats:—

Citronella in Ceylon 140
„ Oil, Ceylon 142
„ Test, Schimmel's ... 142
Lemongrass in Ceylon 140
„ Oil, Ceylon 142
„ „ Refined in Ceylon 140
Schimmel's Citronella Test, Sage and 142
Schleichera or Kusam Oil and Fat... 309

Fibres :—

Bamboo for Paper-making ... 379
Bark Fibre from Calotropis ... 42
Calotropis or Madar Floss ... 44
Cotton Deterioration in Ceylon ... 204
„ Growing Notes 41
„ Improvement by Seed Selection 171
„ in Ceylon 231
„ Seed Selection ... 171, 203, 479
Madar Fibre Plant 42

Dye Stuffs and Tanning Substances :—

Mangrove Bark, Collection and Export of ... 37
„ „ Leather Produced from .. 39
„ „ Trade ... 39
„ „ Utilisation of ... 36
„ Barks, Varieties of ... 36
„ Extract, Manufacture of 38
„ in Africa 36
„ „ East Indies 37

Drugs and Medicinal Plants :—

Cinchona Barks and Cultivation.. 46
„ Formation of Alkaloid in 47
„ Growth of Bark in ... 47
Drugs, Cultivation in German East Africa of 50
Quinine in Cinchona Bark ... 47

PAGE.

Edible Products:—

Cacao Characters of Varieties ... 144
,, Cultivation in Ceylon 73, 144 ... 311, 380, 480,
,, ,, in Gold Coast ... 146
,, Exportations from Ceylon, (1875-1905) 73
,, Fermentation 380
,, ,, Length of .. 385
,, ,, Object of .. 380
,, Fermenting Chambers ... 381
,, ,, in Africa ... 384
,, ,, in Java ... 382
,, ,, in Surinam ... 382
,, ,, in Trinidad ... 384
,, ,, in Venezuela ... 382
,, ,, in West Indies 383
,, Flower Periodicity ... 480
,, Flowers on a Tree, Number of 483
,, Foliar Periodicity ... 480
,, Fruit Characters ... 145
,, ,, Colours of Varieties... 145
,, ,, Wall, Differences in.. 145
,, in Gold Coast 146
,, Root Periodicity ... 480
,, Seed Characteristics .. 311
,, Seeds in Fruit, Number of... 313
,, Tree, Periodicity of ... 480
,, Varieties, Classification of... 144
Cardamoms in the Seychelles ... 322
Citrate of Lime 386
Coconut Bud Rot of 491
,, Cultivation in Trinidad... 155
,, Germination of the ... 232
,, Industry of Trinidad ... 155
,, Notes on 318
,, Oil Manufacture in Trinidad 157
Coconuts, Diseases of 489
,, Pests of 83, 492
Coffee Cultivation in Brazil .. 74
,, Industry in Brazil .. 154
Cola in Gold Coast 148
Copra Drying in Trinidad .. 157
Cotton Seed Meal and Oil as Human Food 388
Dry Grains Cultivated in Ceylon 391, 486
Ginger Cultivation 80
Guava Fruit Pulp 168
Maté or Paraguay Tea 234
Shamshu (Chinese Spirit) from Sorghum 169
Spices in London Market ... 170
Sugar Cane Growing in Trinidad... 167
,, Industry of Philippines ... 166
,, Making in South India ... 78
Tea, Ceylon Import Duty on ... 66, 153
,, ,, "Thirty Committee" 68
,, ,, ,, ,, Resumé of Work of 69
,, in Ceylon, The Oldest .. 150
,, Industry, China 485
,, ,, in Foochow, 1905... 386
,, Deteriorated, Renovation of 57
,, Deterioration, Causes of .. 60
,, ,, Signs of ... 59
,, Green Manures for .. 63
,, Maté or Paraguay... ... 234
,, Pests 194, 394, 492
,, Pruning Deteriorated ... 64
,, Renovation of Deteriorated... 57
Teas, Indian Varieties of ...150 483
,, Leading, The World's ...150, 482

PAGE.

Tobacco Cultivation and Curing 51, 158, 236
,, ,, in Jaffna, Ceylon ...245, 315
,, Curing ... 158, 161, 236, 239
,, ,, Experiments in Madras... ... 56
,, ,, House 158
,, Growing in West Indies .. 51
,, in Jamaica 237,242
,, Pressing and Curing ... 158
,, Ratoons 56
,, Shade-Grown 236
,, Soils.. 243
,, Topping Young Plants .. 55
Vanilla Industry in Seychelles .. 320

Scientific Agriculture:—

Carbonate of Lime in Soil, Effect of Manures on 178
Cattle Manure, Conservation of .. 344
Cotton Improvement by Seed Selection 171
Seed Selection, Importance and Necessity of 171

Horticulture:—

Cabbage Club-root in Ceylon .. 91
Crop Diseases in Ceylon, Vegetable 92
Cut Flowers, How to Keep .. 400
Manures for Nuwara Eliya Gardens 90
Market Gardening in Nuwara Eliya, Ceylon 88
Rotation of Crops 113

Plant Sanitation:—

Coconut Palm, Bud Rot of ... 491
,, ,, Diseases of the ... 489
,, ,, Rhinoceros Beetle on 492
Jungle Stumps, Uprooting .. 491

Entomology:

Bees Boring in Rubber 193
Black Beetle on Coconuts ... 83
Black-headed Caterpillar on Coconuts 83
Brown Moth (*Oxyodes scrobisculata*) in Flight 494
Cacao Thrips (*Physopus rubrocincta*) 248
Camphor Wood attacked by Beetle 492
Case Worms on Tea... 195
Cinnamon Pest (*Euproctis fraterna*) 248
Cockchafer Grub, Cure for ... 249
Coconut Pests in Ceylon ... 83
Cotton Worn, The Egyptian ... 396
Cucumber Fly (*Dacus sp.*) ... 493
Entomological Notes 82, 193, 248 394 492
Flea Beetle, to Destroy the .. 195
Lac Insect on Amherstia ... 195
Lamp Traps for Insect Pests .. 82
Longicorn Beetle 193
Mealy Bug (*Phenacoccus ornatus*), A New 82
Mosquitoes in Batticaloa, Ceylon .. 84
Nettle Grubs (*Thosea*) in Ceylon ... 82
Pyralid Moth on Millet 195
Rubber, Boring Bees and Wasps in 193
,, Cockchafer (*Lepidiota pinguis*) Attacking ... 194
,, Fungus Parasite (*Botryodiplodia elasticae*) ... 193
,, Horned Termite Attacking 194
Red Weevil on Coconuts ... 83

PAGE.

Rhinoceros Beetle on Coconuts ... 492
Sand Fly, Remedy for the ... 85
Scale Bugs on Coconuts .. 84
„ Insects on Coconuts ... 83
Shot Hole Borer (*Xyleborus fornicatus*) in Tea ... 394, 492
„ „ on Shade Trees 194
Sparrow Pest in Ceylon ... 85
Termes Gestroi, the Hevea Rubber Termite 85
Termite on Rubber, The Horned (*Termes inanis*) 194
Tobacco Pest (*Prodenia liltoralis*)... 493
Wasps Boring in Rubber ... 193

Mycology :

Botryodiplodia Elastica on Rubber 86
"Canker" Fungus on Rubber (*Coticium javanicum*) 86
Fungi on Rubber Trees... ... 86
Fusarium on Rubber 87
Javanese Fungi on Castilloa ... 86
Mycological Notes 86
Root Disease of Rubber ... 86
Rubber Fungus Parasite (*Botryodiplodia elasticae*) 193

Live Stock:—

Cattle :

Brandmarks on Kandyan Cattle ... 253
Cattle Crushing by Kandyans ... 407
„ Cure for Ticks in... ... 258
Crushing of Cattle by Kandyans ... 407
„ *vs.* Castration in Ceylon 496
Kandyan Cattle Brandmarks ... 253
Live Stock Shows, Value of ... 408
Mulling or Crushing of Cattle ... 407
Ticks in Cattle, Cure for ... 258

Poultry :

Consumption in Poultry ... 95
Cramp in Chickens 95
Crop Bound Fowls 95
Debility in Poultry 250
Diarrhoea in Poultry 250
Diphtheria in Poultry 250, 406
Diseases of Poultry .. 95, 250, 406, 495
Dropsy in Poultry 495
Dysentery, Fowl 250
Eggs and Overfeeding 252
„ Study on Fowls' 251
Soft or Pendulous Crop in Fowls ... 96
„ Shelled Eggs 495

SERICULTURE—in Ceylon 1905-6 ... 409

Education:

Agricultural Education in Jamaica 401

Miscellaneous:—

Agricultural Banks for Ceylon .. 181, 268, 325
„ Society Progress Report 116, 198, 351, 434, 437, 516
„ Societies, Use and Objects of ... 500
Agriculture, Literature of Economic Botany and, 98, 179, 276, 342, 422, 504
„ in the Kadawatta and Meda Korles ... 185
Agri-Horticultural Show, Kegalle 339
„ „ „ Kelani Valley 337
„ „ „ Kurunegala 335
Alcohol for Running Estate Engines 425
Arts and Crafts in Ceylon, To Encourage 497
Board of Agriculture, Ceylon 115, 197, 350, 433, 436, 513
Botany, Lessons in Elementary 97, 191, 277, 340, 413, 505
„ Literature of Economic 98, 179, 276, 342, 422, 504
Co-operative Credit in Bengal ... 419
„ „ in the United Provinces, India 330, 415
Cotton Meal and Seed as Fertilizers 425
Education in America, Industrial 423
Hindoo Labour in British Guiana 423
Irrigation Methods in Arizona ...271, 323
Literature of Economic Botany and Agriculture 98, 179, 276 342, 422, 504
Mosquitoes and Anti-Malaria Campaign 274
Sanitation on Estates 506

Correspondence:—

Adhatoda Vasica as a Green Manure 266
Ant Hill Earth 347, 510
Beekeeping in Ceylon 114
Capillary Tubes 510
Cotton in India, "Spence" .. 346
Datura Stramonium in Assam .. 113
Eucalyptus, Swamp Gum .. 196
Febrifuge Plants 266
Ginseng Seed 431
Honey Production in Europe ... 267
Interesting Trees of North Ceylon 508
Ipecacuanha 113
Lemongrass Oil Extraction ... 266
Mosquitoes and Anti-malaria Campaigns 503
Mosquito Nettings and Muslins .. 267
Noria Pump, The 507
Paddy Reaping Machine ... 513
Peas, Improved Ceylon Native .. 431
Plantain Growing in S. India ... 511
Pruning Hevea and Cacao Trees... 507
Rotation of Crops 113
Rubber Growing 265
„ Tapping Methods ...260, 345
Sarsaparilla 196
Swamp Gum 196
Tea Planting Industry in Natal ... 263

Current Literature:—

Economic Resources of Uganda .. 349
Le Cocotier 196
Lift Irrigation 349
Memoirs of Department of Agriculture in India 349
Pepper, Varieties of Cultivated .. 432
Relating to the Sugar Industry in Peru 197
Vegetable Growing in Porto Rico ... 432
Year Book, U. S. A. Department of Agriculture, 1905 348

RULES

OF THE

Agricultural Society of Ceylon.

1. The Society shall be called "THE AGRICULTURAL SOCIETY OF CEYLON."

2. The business of the General Society shall be conducted through the Board of Agriculture of Ceylon.

3. The Board shall meet for despatch of business on the first Monday of each month at 2-30 p.m. Seven members shall form a quorum.

4. Notices of motions or questions shall be sent to the Secretary at least one week before the meeting of the Board.

5. All motions will require to be seconded and will be circulated before the Board meets.

6. A General Meeting of the Society may be called by the President at any time and may be held at any place to be fixed by him.

7. All Members of the Board will be nominated by the President.

8. Candidates for Membership of the Society must be proposed by a Member of the Board for the district in which the Candidate resides or owns landed property.

9. Members of the Society shall pay a subscription of Rs. 5 per annum.

10. Payment of the subscription in advance will entitle a Member to receive all publications of the Society. All subscriptions shall be paid to the Secretary of the Board.

11. Lists of Members will be published annually in the *Government Gazette* and in the Journal of the Society.

12. Local Societies may be formed with a Membership of not less than twelve Members.

13. Each Local Society should be represented by a Secretary, through whom correspondence with the Board can be conducted.

14. All Local Societies will be registered at the Local Kachcheri and by the Secretary of the Board.

15. The Revenue Officers of the Province and District shall be *ex-officio* Members of the Local Societies within the Province.

16. Local Societies are empowered to make their own rules.

17. All Local Societies will be entitled to receive all publications of the Society on payment of an individual subscription.

18. The funds of the Agricultural Society will be lodged in the Bank of Madras in the name of the Agricultural Society of Ceylon. The Secretary will be responsible for the accounts, and all cheques will be signed by him and the President or Vice-President of the Board of Agriculture

19. A statement of Expenditure incurred, &c., shall be tabled at each meeting of the Board.

20. All grants-in-aid of Local Societies or special experimant must be approved by the Board.

21. All accounts will be audited annually.

THE

TROPICAL AGRICULTURIST

AND

MAGAZINE OF THE

CEYLON AGRICULTURAL SOCIETY.

Vol. XXVII. COLOMBO, JULY 15th, 1906. No. 1.

Some Possibilities of Improvement in Village Agriculture.

III.

The next point to be considered is the possibility of improving native methods in agriculture. There can be no reasonable doubt that such improvement is possible, but here above all it is very important to know exactly what we are doing, and to be very careful to test things thoroughly and to be quite sure of their advantages before recommending or attempting to introduce them among the natives. Agriculture is a complicated art, and a change in any one item of a cultivation-process may bring entirely unforeseen and perhaps disastrous changes in other items in its train. To take a concrete illustration. A planter living near Peradeniya suggested to the neighbouring villagers that a little manure would greatly improve their paddy-field, and offered, as they could not afford to buy it, to provide them with it free of cost. This was accepted the manure was applied, the crop grew magnificently, the planter was delighted. But when harvest approached, it was found that the ears had been completely destroyed by the paddy-fly, the more rapid growth having perhaps rendered them a trifle less resistant. There is very little doubt that suitable manuring, with improved precautions against fly, might be attended by good results, but the whole matter should have been tested thoroughly on an Experiment Station first; as it is the villagers in the district in question have acquired a prejudice against manuring which may last a century.

Another formidable obstacle to any change in methods is custom. The native is very conservative, and objects to any interference with his time-honoured ways. Thus, for instance, among the Javanese and the Malays, one sees side by side the comparatively advanced method of transplanting the rice (as opposed to the broadcasting of Ceylon and some other places) and the inefficient method of harvesting it by cutting each ear separately with a knife. Yet even in Java the latter is tenaciously adhered to, on account of the fact that the harvesting time is the great festive season, when all the young folk turn out into the fields, and engagements are mostly contracted. In some parts of Southern India the ryots plant their cotton with a drill, in rows; in others they sow it broadcast, getting a less result from more seed and labour. If a

32226

ryot in the latter districts be questioned, he will often admit that the former method is the better, but "it is not the custom" is his reply to the natural inquiry why he does not adopt it.

Another great obstacle is the indolence of the villager. He may know quite well that a particular method is better than his own, and that it will cost him nothing to adopt it, but if it involve more labour than the existing system, or an unaccustomed form of labour, then he will have none of it. Against this rock all attempts to introduce transplanting in place of broadcasting rice have hitherto been shattered in Ceylon. Though the yield is so much better in proportion to the seed and the labour used, the villager objects to the labour of stooping to do the transplanting work. Of course custom has a great deal to do with this result also.

Yet another obstacle, and perhaps the greatest of all, is the poverty of the small village cultivator. This has been fully dealt with elsewhere, and only needs mention here.

There are many other obstacles in the way of progress in village agricultural methods, but the last that need be specially dealt with here is ignorance. There can be little doubt that simple want of knowledge is at the bottom of much that is bad, wasteful, or inefficient. But to remove this ignorance is more easily said than done. It is often suggested that agriculture and horticulture should be definitely taught as such in the schools, and probably some good may be effected in this way, but there is one very great difficulty in this work, that of getting the teachers. The ordinary school teacher is incapable of teaching practical agriculture, knowing less about it than the villagers around him. The teacher who has been to an Agricultural College has usually the characteristic faults of the college-trained native of Southern Asia. He has learnt a great deal of book-knowledge on many topics connected with agriculture, but has little or no notion of how to apply any of it practically or suit it to local needs. If he is sent to teach, he is often dogmatic in the lecture room, and a failure in the field. If he is provided with an Experimental Garden for actual demonstration purposes, he is liable to make a still worse exhibition of incompetence, or to fall under temptation to misappropriate the produce. A scheme of this kind was tried some years ago in Ceylon, and its epitaph was written by Mr. F. R. Ellis in 1899 in the words "Government has not very long ago got rid of the last of a happy band of youths who for a series of years received a good salary for cultivating Crown land with cattle supplied by Government, and appropriating the produce to their own use."

The system of School Gardens is free from many of the objections and difficulties attaching to definite teaching of agriculture in the villages. The masters teach the general principles of agriculture and horticulture by means of plants which are in general unfamiliar to the villagers, and in which, consequently, they do not at once invite comparison and contrast with work going on elsewhere in the village. And there is no doubt that the general principles can be equally as well taught with such plants as with rice, coconuts, or cassava. At the same time, the School Garden practically forms an Experimental Garden for the village, in which the villager can see various "new products," and from which he can get samples for trial, or seeds to cultivate.

There are innumerable directions in which native agricultural methods can be improved, and we can only give a few suggestions here. Thus the tillage of the ground is by rude implements and by a great expenditure of physical labour in proportion to the result achieved. Vast improvements are possible, but we have already dealt with this subject. (See number of "*T. A.*" for April, 1906, page 199.)

GUMS, RESINS, SAPS AND EXUDATIONS.

The Science of Para Rubber Cultivation.

A Lecture by Herbert Wright.

[Illustrated.]

Mr. Herbert Wright, A.R.C.S., F.L.S., Controller of the Government Experimental Station at Peradeniya and author of *Hevea Brasiliensis*, delivered a lecture on the Science of Para Rubber Cultivation in the Public Hall, at Kegalle, on June 9th, under the auspices of the Kegalle Planters' Association. Keen interest was evinced in the event, and the local planters mustered in force, some riding as much as 16 and 20 miles to be present. This is the first lecture on Para Rubber that has been delivered in Ceylon, and is in all probability the commencement of a series. Mr. Wright confined his remarks to "Distance and Pruning," the initial operations; and under these heads discussed exhaustively the principles of planting and the treatment of young plants. He allowed himself half-an-hour and stopped precisely to the minute; but he was able to compress into 30 minutes an amazing amount of useful information. At the close of the lecture Mr. Wright invited questions, and of these there was no lack. Information was adduced which will be read with interest and be found useful to rubber planters all over the island. Mr. Edgar Smith, Chairman of the Kegalle Planters' Association, presided, and there were also present:—Messrs. B. H. Jenkyns, Hon. Secretary, Kegalle P.A., P. T. L. Weatherall, T. R. Walker, A. A. Franklin, C. D. Hunt, Edward Hawkins, G. Hawkins, J. M. Power, A. E. Barrs, A. H. C. Luschwitz, Philip F. Ondaatje, G. Harries and R. Tait, a young Scotch botanist from Edinburgh on his way to Christmas Island to enquire into the agricultural resources and possibilities of the island which is in the hands of the Christmas Island Phosphates Company.

The Lecture.

The Chairman:—I have much pleasure, gentlemen, in introducing Mr. Herbert Wright, who has come to give us a lecture on the Science of Para Rubber.

Mr. Wright was received with applause on rising to speak. He said:—

Mr. Chairman and Gentlemen.—When I yielded to the fourth "dun" from your persevering Secretary and promised to lecture on the subject of Para Rubber, I found myself in an awkward position and wondered what subject to take up which would be of importance to you as practical men. There are so many details connected with the development of rubber plants from the nursery to maturity, and such an abundance of schemes regarding the collection of latex and its conversion into rubber, that I found it most difficult to make a selection which would, without doubt, prove interesting to your Association. I finally resolved, as this is our first lecture on Para Rubber, to begin at the beginning and to discuss with you some of the principles of ordinary planting operations and the treatment of the young plants. If we have time to touch on matters of interest to planters with mature rubber, we will do so, but these can perhaps be brought forward in the form of questions.

DISTANCE IN PLANTING.

The first subject for discussion is the distance at which Para rubber trees should be planted. At the present time, Para rubber is planted at distances varying from 10 to 25 feet apart, and it is obvious that such a variation speaks volumes for our ignorance of the principles of this subject. I do not profess to understand the principles better than anyone else, but I think you will agree with me that the distance adopted should be one which will allow free development of all parts of

the plant, and such as to allow one to collect the latex with ease and to successfully operate against diseases when they arise. Generally speaking, close planting is associated with interference of root growth, production of tall trees, and with the rapid spread of disease; to counterbalance these, we have the protection against exposure and wash, and an increased tapping area. Now let us take each of these questions and see what understanding we can arrive at.

ROOT GROWTH.

We all know how rapidly the superficial roots of Para rubber trees grow, and what a compact mass they form when mature. The lateral roots grow at varying rates according to the conditions prevailing, but if grown on moderately good land, an incremental yearly increase in radius of about 10 to 12 inches may be allowed for. In some districts where the soil and climatic conditions are very favourable, the root growth is more rapid than this, and in others, particularly at high elevations, the growth is not as fast. If such a rate obtains for your estates, it means that it will take five years for the roots of trees planted ten feet apart to completely ramify the whole of the soil, and a proportionately longer period if the trees are more widely planted. If the trees are distanced more than ten feet from one another, there is ample soil in the middle of the lines for the roots of shade trees green manures or catch crops, during the first few years—though ultimately these should be uprooted and only the rubber roots allowed to remain in possession of the soil. If, therefore, you are prepared to tap some of your trees to death at the end of the fourth or fifth year, there is no very serious objection to originally planting the trees ten feet apart, as far as root development is concerned.

DEVELOPMENT OF FOLIAGE.

Naturally one must also consider the rate of development of the foliage as well as the roots. The lateral spread of the foliage depends upon whether the tree is allowed to form a straight stem, as it will do if left alone, or whether it is made to fork and to develop lateral branches instead. Under normal conditions one may expect that the lateral branches of trees planted ten feet apart will have met by the end of the fifth year, and if pruning has been carried out there is generally a considerable overlapping of the foliage from adjacent trees, and the soil is partly covered by that time. The advantages of quickly covering the soil in the tropics are only too well-known and the protection of the soil by any means should be seriously considered. The disadvantages of overlapping foliage are that disease might spread more rapidly and that the functions of the leaves may be impaired. As far as the theory of the interference of foliar functions is concerned, I think it can be dismissed. The leaves are the organs wherein the food of the tree is manufactured; and in order to accomplish this they must, of course, have some light. But it is a very disputed question as to whether the leaves of Para Rubber require all the light which they can get in the tropics, and we all know the beneficial results obtained by growing other plants under shade in Ceylon. The overlapping of foliage consequent on close planting constitutes a self-shade and from considerations regarding the increase in the flow of latex when light is less intense, we may yet find that a moderate amount of overlapping of foliage may be very beneficial for Para Rubber. From the results of experiments, I am convinced that many plants, even in Europe where the light is never intense, do not require constant strong light, but are able to carry on their work when supplied with light intermittently. Intermittent light has been as effective as continuous light, with certain plants, and from these considerations and remembering that light often retards growth, I do not apprehend much interference in the functions of the leaves of Para Rubber trees by a moderate amount of overlapping.

We may, therefore, conclude that as far as the root and foliar developments are concerned, there are no serious objections to the original planting of Para rubber trees ten feet apart. But such a distance is far too close for mature trees and can only be recommended on the understanding that the estates will be thinned-out after the fourth or fifth year. I must, however, remind you that many of our 30-year-old trees are growing well, though they are only eight to ten feet apart.

SPREADING OF DISEASES.

When, however, we come to the question of the spreading of diseases, a subject on which I would prefer the entomologist or mycologist to inform you, I think we are all prepared to admit that an epidemic would spread much more rapidly on a densely planted estate than on one with fewer trees; no matter whether the disease was on the leaves, stems, fruits or roots. Furthermore, the close planting of trees is only possible when thinning-out is intended; this means killing the trees; and if dead stumps are left behind, perhaps assisting in the spread of root disease. The Para root disease, as most of you already know, commences as a fungus on the stumps of trees in your clearings, and by means of slender threads spreads along dead roots, through the soil, to the living roots of the rubber trees. It may be argued that the differences in distance between trees planted ten and twenty feet apart are so insignificant when one considers the vitality of the diseases and their power to spread, that it may be disregarded as an objection to close planting; while I am prepared to admit that there seems some reason in this, I cannot omit to emphasise the necessity to uproot all dead stumps, whenever possible, on estates where closely planted trees have been purposely killed by tapping. It should be remembered that no matter how far apart your trees are planted, the same root disease may appear on stumps left during clearing operations and even widely-planted estates be seriously affected. The disease appears on most rubber properties which have been planted on virgin land on account of the abundance of large tree stumps, and is therefore not confined to closely-planted estates.

ADVANTAGES OF CLOSE PLANTING.

So much then for the arguments against close planting. Now let us consider the other side. The advantages of preventing wash and exposure of our Ceylon soils are only too fully recognised, and I propose to consider a more serious point, *i.e.*, the available tapping area. Every tree, having a circumference of twenty inches at five feet from the base, presents an available tapping area of 1,200 square inches. If you work out this point in connection with the number of trees per acre, when planted from ten to twenty feet apart, you will find that at the end of the fourth or fifth year, an estate planted 10×10 feet has an available tapping area of 522,000 square inches, per acre, whereas one planted 20×20 feet apart has only 130,800 square inches, or approximately only one-quarter of the closely-planted one. This is the great outstanding advantage of close planting, and I would ask you to fully consider what it means during the fourth, fifth, and sixth years. It is, as you know with tea and coconuts, much easier to thin out a closely-planted area than to subsequently interplant a widely-planted one; and when one considers the results obtained with other plants, I do not see why the remaining Para rubber trees should not ultimately make satisfactory progress on closely planted estates which have been systematically thinned out. On any rubber property there is always a proportion of the trees which do not thrive as well as the others, and this is the more serious the fewer the trees on the estate. On an estate closely-planted, the intermediate trees could be killed out in a definite manner until 200 or 250 trees per acre remain after the 8th year. It is almost certain that the yield of rubber obtained by making rubber its own catch crop will pay for the complete removal of all dead stumps and leave a balance of profit worth considering.

PRUNING AND HASTENING MATURITY.

Another subject which is of importance to planters with young clearings, and directly connected with distance in planting, is pruning. We all know how Para rubber plants, closely or widely planted, tend to produce long whippy stems with single whorls of leaves, and that when thirty years old they may consist of gigantic forest trees, nearly 100 feet in height, such as can be seen at Henaratgoda. We also know, from our experience on estates with large acreages of rubber in bearing, that the labour supply necessary for tapping the trees from the base to a height of six to ten feet is very considerable. It must also be remembered that the complete removal of the bark tissues from the base to 6 or 10 feet is an operation which will tax the powers of the tree, and if repeated too frequently may be the cause of premature death. From these considerations, even though I have obtained tremendous yields from the upper parts of the giants at our Henaratgoda gardens I cannot help but think that it would be unwise for planters to speculate on the rubber they are going to obtain, ten years hence, from the long stems of their Para trees. The production of 3, 5, 10 and 25 lbs. of rubber per year from individual trees tapped mainly from the base to ten feet will more than satisfy most planter, when they have to find the coolies to tap the clearings they are now planting, In my opinion—and I do hope you will correct me today if I am wrong—the question for planters to consider is how soon can tapping operations be commenced in order to shorten the long years of waiting, and to place the rubber on the market while the price is high. Remember that by the time the pet clearings you have just planted are in bearing, Ceylon will have 60,000 acres of such trees on the tap, the Straits considerably more, and that India, Java, Africa, Borneo, Sumatra, Samoa, Brazil, and the West Indies are also in the race. I mention this merely to draw attention to the fact that the supplies for the future are rapidly increasing, and it is just as well that every effort should be made to bring the trees to a tappable size and to obtain and sell your rubber while the price is over 5*s.* per lb. When the price drops to what it was ten years ago, viz., about 3*s.* per lb., then you can perhaps give your trees a rest and let them grow, uninterrupted, as nature may determine.

WHEN TO TAP, AND PRUNING.

Our subject is closely associated with the production of trees of a tappable size, and we must, therefore, discuss this question. Opinion seems divided as to whether age or size should form the criterion in deciding when trees should first be tapped; but I am of the opinion that, given a minimum age of four years, size is the consideration of most importance. Trees younger than four years can usually be disregarded because the rubber from them is invariably poor in quality and quantity, and the removal of bark from them would probably appreciably affect their health and future vigour. Trees, when four years of age or more, vary considerably in size; but if they have a circumference of much less than 20 inches a yard from the ground, systematic tapping cannot be confidently recommended. If the trees have this circumference, tapping can be commenced, and we have now to consider what means are at hand which will affect the acquiring of the required dimensions. Of course, good tillage and manuring will always be a great help, but I propose today to discuss another question, namely, the production of increased foliage by careful pruning.

EFFECT OF FORKING.

You have been previously treated to a general discussion on this subject by correspondents to the Press; but as most of the points have been inadequately touched upon, and my original suggestions more often than not grossly misinterpreted, I think it will be as well if we can clear the air at this meeting. Since I first suggested the experiment of pruning whippy Para trees, I have obtained numerous letters quoting the dimensions of straight-stemmed and forked trees of the same

PLATE A.

Photo by Ivor Etherington.

PRUNING YOUNG PARA RUBBER PLANTS.

1\. Straight-Stemmed. 2. Three Months after Pruning.

Straight-Stemmed and Forked Plants 20 Months Old.

age, and the results from Monaragala, Dumbara, Kalutara, and Matale do, I am glad to say, support the original idea. In the first place I want to remind you of the tendency of Para rubber plants to produce tall, woody stems with whorls of foliage one above the other and to impress upon you the fact, known to all horticulturists, that growth in height may be checked and that in girth increased. The energy of the plant, used in the production of high, bulky, woody tissues, may be directed to the production of the same material in the base of the stem and to that of branches bearing foliage. The success of the pruning experiment depends upon checking the formation of high wood and increasing the foliage. The leaves of a plant are of vital importance and are the organs wherein the food supplies are elaborated. If you repeatedly remove the leaves or diminish their numbers the production of food supplies is seriously affected and the increase in circumference of the stem is reduced. We have some cuttings of Dadap, planted two years ago, which, on account of the leaves having been hand-pruned every month, are of the same thickness today as when they were first planted. In the same way one may state that an increase in foliage increases the rate of food manufacture and therefore provides the materials necessary for the stem to grow at a quicker rate.

FORKING AND FOLIAGE.

It is necessary to first prove what happens when the terminal bud is removed by the thumb-nail or the knife. If you examine a Para rubber plant, ten to fifteen feet high, you will notice that the upper part of the stem is green ; this is the part which will throw out numerous lateral branches if the growth in height is stopped by removal of the terminal bud. If, as has often been done in the Straits and Ceylon, the whole of the green wood and foliage is cut away, the probability is that the remaining stump will only throw out a single shoot and you will be no better off. The result which follows careful removal of the terminal bud is best seen in the photograph I have here. (*See plate A.*) This photograph shows two plants of exactly the same age, grown from seeds from the same parent. In one case the plant has been allowed to grow into the usual long and slender stem, and, when I left Peradeniya, had only three whorls of foliage. The other tree, about four months ago, had its terminal bud removed by thumb-nail pruning, and being unable to grow in height, has thrown out ten lateral branches. The result is the straight-stemmed tree has still only one growing point at the apex of the stem, whereas the pruned one has ten, and from each are produced whorls of foliage. Though the pruning was only done recently, the plant so treated has no less than 200 fully-developed leaves, whereas the one which has been allowed to grow in its own way has only about 50 leaves. That, gentlemen, is within four months. The food-producing capacity of the pruned tree, as far as the foliage alone is concerned, is now four times as great as that of the straight-stemmed one, and it stands to reason that the basal part of the pruned tree will grow at a quicker rate. The operation itself is a gentle one and does not partake of anything so drastic as the cutting away of the upper part of young or old trees. The lateral branches each produce their own whorls of foliage as though they were members of separate trees, and as they tend to grow more or less upwards may themselves require pruning at intervals of three or six months. If there is anyone who doubts the effect of pruning the terminal bud, I need only ask him to consider what happens when he prunes his tea bushes for the first time. As an example of a system of pruning the following will serve our purpose ; the tree may be thumb-nail pruned when twelve feet high and two branches allowed to develop, one on either side ; in about one-and-a-half month's time those two lateral shoots will be a little over a foot each in length, and can be again pruned and half-a-dozen shoots allowed to grow from each ; in four or five months' time these shoots will be from four to six feet in length and may be finally pruned at the apex and allowed to develop as many branches as they

care to. The result of this will be that the tree, which has been pruned three times in a period extending a little over six months possesses a main stem ten feet in height, and twelve branches; each of the dozen branches have their own growing point and produce as many leaves as the single growing point at the apex of the stem of the unbranched tree. By this means the food-producing power of the tree which has been pruned will be about twelve times that of the single-stemmed one. If such conditions do not result in an increased rate of growth for the basal ten feet of stem, I shall have no hesitation in throwing up the sponge.

EFFECT OF INCREASED FOLIAGE.

I think you will now all admit that it is possible to lead to the production of a large number of branches, and we have next to enquire how soon the effect is obvious in the girth of the stem. The two plants in the photograph I have here (*see plate A.*) are over one-and-a-half years old from stumps, and the forked one shows a circumference of 4 4-5th inches as against 4 inches for the straight-stemmed tree; this means an increase of over half-an-inch within six months of the pruning operation. The young trees on various estates in Ceylon and the old trees at Henaratgoda (*see plate B.*) indicate that an average increase of about one inch per year may be obtained by making them fork at the proper height. I cannot guarantee to convert your young clearings into "baobab" plantations, but if you will measure your forked and straight trees which are of the same age, and which have been grown under identical conditions; I think you will soon have sufficient figures to convince you of the increased circumferential rate of growth, which is likely to follow careful pruning. If you can obtain an average increase of one inch per year, it means that you gain a year in the first four or five years and the minimum tapping size of 20 inches will be attained in the fourth year. The only disadvantage which I have heard urged against this system is that it may be followed by too much overlapping of the foliage, necessitating that the trees be planted at greater distances. This, in my opinion, may be an advantage instead of a disadvantage during the first few years, and I cannot think that it constitutes a serious argument against the experiments I have placed before you. Now, gentlemen, I have had my say, and as I am here today more to promote or aggravate discussion than to give information, I hope your remarks will not lack in eloquence or vitality, and that you may at least be induced to try your own experiments on the rubber clearings you are now planting. (Applause.)

THE DISCUSSION.

CLEAN WEDDING *v.* INTER-CROPS.

On questions being invited,

Mr. Edgar Smith asked:—What is your opinion about clean weeding on rubber estates?

Mr. Wright:—Ceylon is unique in so far as that most of the estates are clean weeded; but providing the roots of the weeds or whatever plants are grown in addition to the rubber, do not interfere with the root development of the Para rubber trees, there is no disadvantage, but a great advantage in having the ground covered.

Mr. Smith:—What about ordinary grass?

Mr. Wright:—I recently heard of an experiment which had been carried out by a prominent member of the planting community whom you all know. He assured me that purely as an experiment he had the ground under Para rubber trees covered with ordinary turf. The rubber trees, protected in this way by the grass, did wonderfully.

PLATE B

Photo by H. F. Macmillan.

THIRTY YEAR OLD PARA RUBBER TREES IN CEYLON.

1. Forked Tree.

2. Straight-Stemmed Tree.

Mr. Smith :—I tried grass.

Mr. Wright :—The gentleman refered to had the ground under certain trees turfed, and he said that if it was practicable to turf an estate it would be a very good thing. There is one advantage about grass; the root system is not as penetrating as the root system of many other plants. If you grow plants which throw out their roots at such a rate and in such a manner as to interfere with the root development of the rubber, then harm may be done.

Mr. Walker :—The trees at Henaratgoda are planted through grass. They are unweeded?

Mr. Wright :—I understand that they were attended to for the first few years; when a rubber estate is 5 years old, weeding is negligible.

Mr. Smith :—Coconut estates have grass and cattle are put in to feed on it. Why should not the same be the case in rubber? Why not let the grass grow and keep cattle?

Mr. Wright :—Once a rubber estate is matured you cannot grow anything under the rubber.

Mr. Smith :—The estate I am thinking of is three years old.

Mr. Wright :—I think that encouraging cattle on rubber places is not a very commendable thing. The cattle will probably do more damage than anything else. At the same time the protection of the soil by any means is a consideration which should not be lost sight of. I cannot say I think grass as good as some plants that might be used. What I should like to see growing is some plant of low habit that would give a lot of organic matter.

Mr. Frankland :—Would the sensitive plant do?

Mr. Wright :—It would be beneficial, although my opinion on this question of growing crops of any kind in rubber is that they must either be considered as crops or green manures, or you must make up your mind to let the estate be clean weeded. The former is often a difficult system to work.

Mr. Frankland :—But for protection of the soil?

Mr. Wright :—On some estates, where Albizzias have been used and lopped when less than two years old, you can see the two-year-old Para rubber trees quite 10 feet above the level of the Albizzia plants, protecting the soil, all over the place.

"THE FIRST PINCH."

Mr. Walker :—What height would you recommend for the first pinch of the plant?

Mr. Wright :—I think planters will be content to tap plants from the base to 10 feet. I do not think they will ever want to tap to 30 feet as we have done at Henaratgoda. Therefore, if they prune so as to leave a stem 10 feet from the base and allow it to remain I think it will be quite sufficient.

Mr. Walker :—Then you prune again at 15 feet?

Mr. Wright :—Then let the branches grow out, one on either side; when a foot-and-a-half long prune again and let the next shoots grow until they are 5 feet long and make your final pruning and leave the tree to itself.

Mr. Walker :—The branches will be very thick if you prune over 10 feet.

Mr. Wright :—No: I do not think so. I do not really see your objection.

THE QUESTION OF WIND.

Mr. C. D. HUNT :—How does the question of wind enter into the argument? If you increase the foliage of the tree, it is liable to be blown over.

Mr. WRIGHT :—Do you think a properly established rubber tree would be easily blown over?

Mr. C. D. HUNT :—I have seen a good many.

Mr. WRIGHT :—A good many Para trees have been blown over, but that was not due to wind alone. On one estate, I believe, about 200 went down in a day, but that was due to diseases affecting the roots. The manager did not know what was wrong until he pushed one of the erect trees, and down it went. However, that is an interesting question as to the effect of wind raised by Mr. Hunt.

Mr. HUNT :—We do not, of course, admit we have wind here. (Laughter.)

Mr. WRIGHT :—Would you consider that the increased foliage would tend to make the tree liable to be blown down on an average estate?

Mr. HUNT :—I have seen young trees blown over, and especially young trees grown in paddy lands. They seem not to be able to grow down as fast as they do above.

Mr. WRIGHT :—The Para rubber tree has a well-developed and magnificent system of lateral roots and also a long tap root. I should say that if a well-developed Para rubber tree on good soil could be blown over many strong trees of other kinds might be blown over.

ROOT DISEASE.

Mr. HUNT :—Does this root disease not affect tea?

Mr. WRIGHT :—Of course that is a thing for Mr. Petch to reply to. It behaves to a certain extent in the same way and the treatment is somewhat similar. In the one case it is usually due to *Rosselinia* and in the other to a fungus called *Fomes semitostus*—a different fungus altogether. Mr. Petch can give you some interesting information on that point.

Mr. HUNT was understood to say that he had seen rubber planted among tea become absolutely black and die from disease beginning at the top. The rubber was five years old. The tea was perfectly healthy, but the rubber tree was dead.

Mr. WRIGHT :—If it died from a disease beginning at the top, the cause may be different from root disease.

Mr. HUNT :—Well, if you scraped away the earth, you would find a lot of greasy matter about the roots.

Mr. WRIGHT :—In root disease the decay would tend to be from below upwards.

Mr. HUNT :—The tree was practically dead all the way up. There were some good branches 10 feet high, but over that the main branches had lost the leaves and branches too.

THE PERIODICITY OF THE PLANT.

Mr. SMITH :—Have you noticed in your travels that on some places the trees are flowering now?

Mr. WRIGHT :—On estates which have been tapped rather severely the periodicity of the plant is all upside down. I mean to say there is a tremendous variation. On some estates you will find the trees just putting on their new foliage, on others the trees are leafless, and others have not shed their leaves; you will find flowers on those which have recently regained new foliage.

Mr. SMITH :—I have seen a tree in flower with ripe seed. Does that not mean death?

Mr. W :—If you attempt to kill most trees you usually get a copious blossom which does not usually seed; it is the last effort to reproduce seed, and there is no doubt that the removal of the bark, very frequently, upsets the natural periodicity of the plant. The bark is the means whereby the materials in the leaves are conducted from above downwards and on which the tree feeds; if you cut that away, it may become a very serious matter if done too often.

SHOULD A FLOWERING TREE BE TAPPED?

Mr. SMITH:—Is it right to tap a tree when it is flowering?

Mr. WRIGHT:—That is a difficult question to decide as far as the yield obtainable during that season is concerned.

Mr. SMITH:—Does it affect the seed?

Mr. WRIGHT:—Any treatment will affect the seed in some way or other if it is severe enough. The effect of tapping upon seed is a rather complicated one. It is possible to imagine, should you tap trees, you may induce favourable characteristics in the seed; if you train a tree up to give plenty of bark and produce distended latex tubes, it may lead to a similar formation in the seed and it may be an advantage to have seeds from tapped trees. But on the other hand if the ordinary tapping operation is conducted in a manner which threatens the life of the tree, it may lead to deterioration of the seed. It brings up the whole subject of whether you can induce characters which can be transmitted by seed, a difficult question to settle off-hand.

Mr. HARRIES:—During February and March I noticed flowers on 4-year-old trees, but they never came to anything. They all fell off.

Mr. WRIGHT:—I think trees have been known to flower and seed when 2½ years old in the Straits; when they are 4 to 5 years old in Ceylon, flowering frequently occurs.

Mr. HARRIES:—But why February and March?

Mr. WRIGHT:—That is to some extent irregular if it occurs in February in Ceylon. The flowers usually come out a month or so after the new leaves on a young tree.

Mr. HARRIES:—But this was a 4-year-old tree.

Mr. WEATHERALL:—Are you sure it was a rubber tree? (Laughter.)

INCREASE OF GIRTH AND BARK.

Mr. B. H. JENKYNS:—Does this increase in the circumference of a tree lead to an increased thickness in the bark of the younger tree? It is a physical impossibility to tap a young tree. The bark is not thick enough and you go into the cambium every time. What I want to know is whether, by increasing the girth of the tree as you suggest, you increase the thickness of the bark?

Mr. WRIGHT:—It is rather a complicated and technical point. The cambium produces wood internally and bark externally; these tissues are formed in a regular manner, so many wood cells being produced for a definite number of bark cells. If the cambium produces more wood, it must necessarily produce more bark, because the two tissues are produced in definite proportions. That is why—in valuing different estates—you can approximately judge the thickness of the bark by examining the rings in the wood of the stem. The broader the rings of growth in the wood, the thicker the bark. Any increase in growth almost invariably means an increase in wood and bark; it is unusual to get one growth without the other.

Mr. JENKYNS:—In a pruned tree of four years old, you would have a sufficiently great thickness of bark to get a cut into it, while in an unpruned tree of the same age you probably would not.

Mr. WRIGHT :—A tree having a circumference of 20 inches would have a bark representing to some extent the development of other parts of the tree; and if you tap trees much under 20 inches, although many estates are doing this, it is hard on the bark and the rest of the tree and must affect its future health.

Mr. SMITH :—And bring on disease?

Mr. WRIGHT :—That is a disputed question.

Mr. SMITH :—But it is more liable to it?

Mr. WRIGHT :—That is so in some cases.

THE AGE FOR PRUNING.

Mr. FRANKLIN :—At what age would you recommend pruning?

Mr. WRIGHT :—I would rather not consider age. The size of trees of the same age varies so much. I would first prune at 10 to 15 feet—prune to such a level that it will allow you 10 feet to tap. I do not believe that high tapping can be considered in the future.

VARIETIES OF BARK ON PARA TREES.

Mr. HUNT :—What accounts for the absolutely different bark on the trees? Some have a polished plain and pink colour and others have a very sawdusty and very crumbly bark. They seem to be distinct trees to cut. Is there any particular reason for this?

Mr. WRIGHT :—It is only what occurs in most plants. You are dealing with one species, and when you have two million plants it is only natural to expect that there should be some variation.

Mr. HUNT :—The pink bark is a very thin and a high-yielding one?

Mr. WRIGHT :—Jumelle, Ule and other botanists have made or recorded observations conducted in the forests of the Amazon valley. Like others they concluded that the seedlings from five hundred seeds from the same tree might produce more varieties than can be detected in the average forest. It is a natural variation and nothing more. Two species of Hevea have been introduced to Ceylon, but only *Hevea brasiliensis* has survived.

Mr. HUNT :—A gentleman was visiting me, and as far as the growth and yield of my rubber was concerned, it compared very favourably with other places, but the characteristic that struck him was the smallness of the leaves compared with the trees on other estates. Even on big trees as well as on saplings the leaves were all very small.

Mr. WRIGHT :—You did not think you had got the wrong variety did you?

Mr. HUNT :—My yield compared very favourably.

Mr. WRIGHT :—With a tree it is very difficult to make selection experiments. You have to let it grow into a tree, and by the time you find out its real value it is 8 years old, and it is then time to take a rest.

TAPPING ALL THE YEAR ROUND.

Mr. SMITH :—Do you believe in tapping all the year round?

Mr. WRIGHT :—That is a difficult question to answer right away. We have been conducting experiments to determine the best frequency for tapping, and it is rather curious that tapping every day has given less rubber than tapping every alternate day from trees tapped at Henaratgoda from 26th September up to date. The trees tapped every alternate day gave something over 10 lb.

per tree; those tapped every day gave far less. But the worst feature of this is that the trees tapped every day have hardly any bark left, and even if such frequent tapping had given as much rubber as tapping every alternate day, the loss of bark alone would have been against tapping every day.

THE PRICKING SYSTEM.

Mr. HUNT:—Don't you think the pricking system is the best thing in cutting open the wounds?

Mr. WRIGHT:—It is a difficult question. I am a strong believer in incision instead of excision. The extraction of latex has very little effect on the trees. In fact the majority of the plants grow well without any latex. It is the paring away of the bark that does the damage. It is only when we cannot get more milk by pricking that we pare away the bark.

Mr. HUNT:—The question of cost per lb. comes in with us.

Mr. WRIGHT:—That may be so; but I think the consideration should be how much you can get per square foot from the bark.

Mr. HUNT:—Three lb. in 6 months would be better than 6 lb. in 9 months to us.

Mr. WRIGHT:—In some of the experiments we have got approximately one ounce of rubber per square inch of bark removed, but we only get such high yields when the bark is removed slowly. We get it by incision not excision. By paring instead of pricking we have got in some cases yields nearer one ounce per square foot instead of one ounce per square inch. It is better to allow the bark to remain on the tree for as long a period as possible rather than manufacture large yields of rubber from shavings.

PRICKING *versus* PARING.

Mr. WRIGHT—replying to Mr. Jenkyns:—You are the persons to decide whether a system of pricking or paring is best.

Mr. SMITH:—If I do not pare, when I put on the pricker, it simply sticks.

Mr. WRIGHT:—I was over an estate last week where they have these drip tins. The Superintendent tapped some trees without using the tins, and nearly the whole of the rubber coagulated in the cuts. Where the tins were used at the end of two hours the water coming out was milky showing that the latex had not stopped. There was no scrap in the cut and I was interested, in speaking to the gentleman, to hear that he had reduced his scrap 75 per cent by using them.

Mr. SMITH:—It is a very big order to put them on.

THE LEFT-HAND AND RIGHT-HAND CUT.

Mr. HUNT:—Can you tell me if there is any difference between the left-hand and the right-hand cut?

Mr. WRIGHT:—I have recognised no difference whatever, so far as the yield of rubber per square inch of bark is concerned. I think most people said they got less by the left than by the right.

Mr. HUNT:—Yes.

Mr. WRIGHT:—It is perhaps more difficult to cut that way. There is a tremendous variation per square inch over every tree.

THE VARIETIES OF PARA RUBBER TREES.

Mr. HUNT:—Did not the man, who introduced Para rubber to Ceylon, bring six different varieties?

Mr. WRIGHT :—I have never seen correspondence to that effect. The plants were sent on to Peradeniya. Some were *Hevea Brasiliensis* and others *Hevea Spruciana.* The latter was tried and proved to be a failure at that time. I hear that sometimes in the Amazon district they tap both and mix the two of them with *Sapium aucuparium.*

CLOVER GRASS IN PLANTATIONS.

Mr. FRANKLIN :—Can you tell us whether the small native clover grass would do any harm if it was allowed to grow?

Mr. WRIGHT :—The clover you mention, if it is the same as I am thinking of, is really a useful manure and is moderately rich in nitrogen.

Mr. FRANKLIN :—If the rubber is clean weeded and it is allowed to grow in lines, would it be a good thing?

Mr. HARRIES :—I think it is the same weed as grows in the Kurunegala district coconut estates.

Mr. WRIGHT :—As long as it does not get round the rubber trees and make a mess, it is all right.

Mr. JENKYNS :—Is it not more like a violet than a clover leaf?

Mr. HARRIES :—It grows along the ground.

WHAT IS THE BEST SYSTEM OF TAPPING?

Mr. HUNT :—Can you tell us which is the best system of tapping as regards the future vitality of the tree; the herring bone, spiral, semi-spiral or V systems of tapping—which do you think the best to do?

Mr. WRIGHT :—Presuming that each system is carried out properly? It is rather an interesting point. If you work out the rubber obtained by tapping, you find the maximum yield in the same period of time is given by the full spiral. You get more rubber in a given period of time from the full spiral than from the herring bone or by the half-spiral; but when you come to work out the weight of rubber obtained per unit of bark excised you find the full spiral gives you the minimum of rubber per square inch of bark cut away, and it may be considered the best system for places requiring thinning out. The half-spiral, though it gives a low yield in a given time, gives the maximum per unit of bark cut away.

THE BEST PART TO PRACTISE TAPPING ON.

Mr. HUNT :—Suppose you are going to do bad tapping—everyone must do a certain amount in teaching coolies and so on--is it better that the cambium should be cut near the ground or further up; or would it be better to erect staging and let them cut further up?

Mr. WRIGHT :—I am inclined to think that where you think there is very much risk you should give them a branch—the first branch you can get--rather than give them any part of the main stem. After all is said and done, the tree itself is a moderately hardy one.

Mr. HUNT :—You would get no rubber there, the bark is so small.

Mr. WRIGHT :—If anything I would put them on the upper part above 6 or 10 feet. I think you will have quite enough to do to attend to the first 6 feet when you have a few thousand acres going. I do not think it matters very much what part of the tree you damage; it is so hardy. We have rather

AN INTERESTING TREE IN HENARATGODA.

In January, 1903, it was killed by some means or other and was cut off, about four feet from the ground. It is waterlogged and seems quite rotten, but if you tap that bark which has shown no signs of life for three solid years you will get rubber.

We are tapping that apparently dead stem every alternate day and preparing biscuits from the latex. It is a very hardy tree and I would recommend putting the cooly on the top part of it. Of course, the cooly can practise on jak trees until he gets into the habit of feeling the wood.

A MEMBER :—They use an axe in the Amazon.

Mr. WRIGHT :—That is the native method. They don't cover the same parts every day. They go to a group of trees and work that and then go to another group, for three months at a time, and then go back.

Mr. HUNT :—I do not see how we are going to be able in the future to do more than work patches for six months at a time.

Mr. WRIGHT :—I am glad to hear you say that. People think it is going to be an advantage to let their trees grow up to a huge height, but you will never be able to tap above six feet when you have got 60,000 acres in bearing in Ceylon. That is one of the greatest points to consider. Ten feet at the outside will be quite enough.

Mr HUNT :—That would be a stunted tree.

Mr. WRIGHT :—All the branches tend to grow upwards and not horizontally.

THE MOST EVEN RENEWAL OF THE BARK.

Mr. JENKYNS :—Which system of tapping will give the most even renewal of bark without any pits or hollows ?

Mr. WRIGHT :—Naturally the full spiral will give the most even stem, but I do not think there is such a great advantage in having an even stem except from an artistic standpoint.

Mr. JENKYNS :—For instance in the herring-bone system there must be some of the original bark left and you cannot get a perfectly even bark.

Mr. WRIGHT :—I wound not recommend the spiral system simply because it gives an even bark.

Mr. JENKYNS :—But you want an even bark for the second tapping.

Mr. WRIGHT :—You want to get a system which allows you to cut in a definite system from above downwards through all parts of the trunk. The half spiral does that ; so does the herring-bone and the full spiral, but, of course, in all other systems except the full spiral you are apt to get one side cut and the other side not cut.

"WARTY" TRUNKS.

Mr. JENKYNS :—I have seen old rubber trees so knotted with lumps as big as your fist that you could not get any surface to cut on.

Mr. WRIGHT :—Once these are produced, it is difficult to do anything.

Mr. JENKYNS :—The idea in my mind was what is the best system to avoid that and produce an even renewal of bark.

Mr. WRIGHT :—The best thing where the tree is knotted or warty is to leave it alone and tap a higher part. These knots often work themselves out.

Mr. HARRIES—referring to the illustration in Mr. Wright's book of Tapping on Arampola estate, Kurunegala—asked if after the Vs had been healed over they could not extract more latex by pricking them ?

Mr. WRIGHT :—If you allow too long a period between the paring and the pricking to elapse, you lose all the value. After the first cut the wound response is developed and the milk flows to heal up the wound, and when you prick you cut the inflated laticiferous tubes and get a larger flow.

Mr. HARRIES :—You get a second lot by pricking ?

Mr. WRIGHT :—Yes.

Mr. HUNT :—What is the actual function of latex in rubber ?

Mr. WRIGHT :—Ask me another. (Laughter.)

Mr. HUNT :—Why does it rush to the wound ?

Mr. WRIGHT :—It has been suggested that it may prevent insects getting in. It is, however, a minor point. Think how many plants at home and abroad grow without laticiferous tubes ? Most people have concluded that latex acts more as a water storehouse than anything else. If it had any important functions, you would expect that after you had taken 25 lb. of rubber from one tree, it would show some bad signs.

THE QUALITY OF RUBBER.

Mr. Hunt—asked if they tapped every third day, although they might not get the same quantity, did he think they would get a better quality ? Did not the extra time allow the latex to mature ?

Mr. WRIGHT :—It would not be sufficiently prominent to influence the present market value of rubber. I do not think any difference would occur which would be capable of being detected by the man who buys the rubber.

Mr. HUNT :—The injured rubber would travel up slower through the bark than if you were tapping every day. You would get a bigger percentage of rubber than water ?

Mr. WIRGHT :—We have been working out the quantity of rubber per known volume of latex from trees tapped for the first time, and more often than not the first tapping gives 50 per cent of water. In some case tapping the renewed bark we have got 90 per cent of water. and in most places—in the areas most frequently tapped—the percentage of water increased. You would expect that the water simply filters through one cell to another. Our experiments prove, as far as we have gone—they may be entirely contradicted afterwards—that we have got better results in weight of rubber for a given time and for a unit of excision by tapping every alternate day.

Mr. HUNT :—By tapping, you mean any method of extracting rubber:

Mr. WRIGHT :—It is merely a question of opening the milk tubes. We have up to the present got the best results from tapping every alternate day.

A POINT ON PRUNING.

The CHAIRMAN :—How would you prune a tree 18 months old and 20 feet high ?

Mr. WRIGHT :—We are using American pruners. The length of the pruner is about the same as the wall of this building. The cooly reaches to the top of the 20 feet and he just cuts off the top. You cannot do the real true thumb-nail pruning in that way.

Mr. SMITH :—Would you cut it down to 15 feet ?

Mr. WRIGHT :—No. You want to leave plenty of green stem so that lateral branches may arise. It is too late to prune if you let the trees grow to a certain height without sacrificing the whole principle. In your case I should be inclined to cut the terminal part away with just a few leaves.

Mr. SMITH :—I have pleasure in proposing a hearty vote of thanks to Mr. Wright for the most interesting lecture he has given us today. Mr. Wright is, unfortunately, unable to come round our estates this visit; but I hope he will be down again shortly and spend two or three days in the district. We will be able to show him some very fine properties, I think. (Applause.)

The vote of thanks was accorded with much heartiness.—*Ceylon Observer.*

The Cultivation of the Castilloa Rubber Tree.

THE METHODS EMPLOYED ON A NICARAGUA PLANTATION. II.

Another point in the number of cuts is the time and labour in making the cuts. Six cuts to a tree is twice as much labour as three cuts, but if it does not give twice as much rubber it would be cheaper to make three cuts and tap a large number of trees in a day. The tapping is now being done with only three cuts per tree : one at the base, one at five feet from the ground, and one half-way between these. Tapping above five feet necessitates the use of ladders, and this would mean more labour and would hardly pay with young trees. I believe the making of four cuts, the top one six feet from the ground, would give enough more than three cuts to pay if it is not too great an injury to the tree.

Three methods of tapping have been used by planters around here. The first is the native method of tapping with a machete. Many wild trees have been killed by this method, and for that reason it was condemned at the beginning. I do not think the method is as bad as it has been considered. I believe the wild trees died because of the number of cuts, the short distance between them, the tapping of roots and spurs, etc., rather than owing to the depth of single cuts. Of course, the cuts are crude, and often expose too much wood, but the method is not so bad as it has been considered, and if in the future when the trees are large and the bark very thick and tough, it is found that the tapping tool cannot be used, there would be no great danger in using the machete.

The second method is the single incision method. This method is founded on the belief that it is dangerous to remove any bark from the tree. In order not to dig out a channel for the latex to run in, the cuts are made short enough to collect all the latex from each cut in one cup. The tapping is done with a chisel a little over an inch long, and a ring of cuts of this length is made around the tree in place of one cut. This method has a number of disadvantages. It involves a lot of labour to make the cuts and place the cups on the tree, etc. It requires a large number of cups, and these cups must afterwards be washed. The number of cups which must be placed on the trees is so great that the men cannot place them carefully, therefore they frequently do not fit on the trees, and the chink between must be filled with a bit of mud, which gets into the latex and makes it much harder to manipulate. This last objection can be remedied by a different form of cup.

The third method of tapping is with a tool. This method makes the same sort of incision as the machete, but makes it much more neatly, and no particular skill is necessary to do it. The tool cuts out a V-shaped piece of bark, leaving a grove in which the latex can flow. The cut is made somewhat obliquely, and the latex runs out at the lower end where the cups are placed. Generally two cuts overlapping at their lower end, and each passing halfway round the tree are made. The cuts have been generally made nearly halfway round, but a small space between the two left at the upper ends, so as to be sure that the tree would not be greatly injured. I do not think this is necessary, as the trees are apparently not injured if the cuts overlap at each end. I do not think that the herringbone method is necessary or advisable for *Castilloa.* The vertical channel leading all of the latex into one cup at the base I should imagine would be injurious, and the yield of *Castilloa* is so great that a very large cup would be necessary. The cups now being used are filled, or nearly filled, by the two cuts. The cups at the bottom cuts sometimes run over.

The healing of the cut is another matter which must be considered. The general idea has been that the cut must not be made too deeply, and this is true to a certain extent. Trees here show, also, that it must not be made

too shallow. Between the bark and the wood is the growing part of the tree known as cambium. This part alone has the power of forming new bast and new wood. If a cut is made which does not go into the cambium, the cut will not heal over with new material. Of course it will dry up and turn black, and in this way protect the tissue under it, but the piece of bark taken out is gone for ever. On the other hand a cut made just to the cambium will heal quickly. The first signs of healing appear between one and two weeks after the cut is made. and in two months at the latest the cut is well healed. In time the whole cut will fill with new material which contains latex, and can be tapped again if necessary.

Another strong reason why the tool should cut to the cambium is that not only does the shallow cut miss cutting some "milk tubes," but it misses a very large proportion of the "milk tubes." The "milk tubes" are formed by the cambium in layers. The ones closest to the outside bark were formed when the tree was very young, and small in circumference, say eighteen or twenty inches. The spaces between these tubes are filled by medullary rays which run from the pith outward through the wood to the outside bark. Therefore the outermost layers contain very few milk tubes, the next more, etc., until the innermost layer has the most, since it was formed when the circumference was greatest. This is borne out by facts. A much larger yield is actually obtained by cutting into the cambium than by cutting almost into it.

Another thing to be avoided is cutting too deeply. When a cut goes through the cambium into the wood, the healing commences at the edges of the cut cambium and has to spread slowly, making new cambium before it can make new bark or wood. If too much wood is exposed in this case it will often dry up before the cambium can heal over, and in that case it never heals. I have seen an old machete cut with half-an-inch of wood exposed, the bark thoroughly healed all around it. I was told that it had been that way without healing for two years.

The shape of the groove cut in the tree is a case for investigation. Whether the V-shape should be wide or narrow is under dispute. Those who do not believe in taking away bark would argue that it should be as narrow as possible, and yet hold the milk. At least one planter here thinks that the wider cuts yield better. I see no reason why they should except that possibly the flow would be checked in a narrower cut by its becoming blocked with rubber. I am inclined to think that the narrower the cut the better, and that it might be possible to have such a tool that the groove would be cut entirely in the outer half of the bark, the inner tubes being cut by a single blade cutting to the cambium. Such a blade could hardly cut the wood, but could cut all milk tubes. A pocket knife cut heals more quickly than any other, but of course makes no groove for the milk to flow in.

WHEN TO TAP.

The time to tap is another point. There appears to be no reason why the trees should not be tapped at any time during the rainy season. I should imagine that the driest season, in March and April, would be a poor time, but I have not been here during that season. Rain generally makes the milk rather watery, and makes it flow more freely, but I have never seen it so watery that it would not pay to tap, except in a tree which had been recently tapped. Tapping in heavy rain would not do, as it would wash the latex, which does not flow into the cups, and might fill up the cups and spill the latex in them.

Temperature affects the flow of latex very noticeably. The yield of rubber is much greater in the early morning than at any other time of the day, and always decreases towards noon and increases towards night. This is not so noticeable on cool cloudy days. It would probably not be so noticeable in a shady

plantation, and for this reason some people have claimed that shade-grown trees yield more. I believe that the reason temperature affects the flow is because a large amount of the water is evaporated, and the latex is more solid and does not flow so freely.

COLLECTING CUPS.

In gathering the latex the first consideration is the cups. The cups now used are made of sheet-tin cut to the right shape, bent round, and soldered on one edge. The side which goes against the tree is cut in a curve which can be made to fit any sized tree by slightly changing the angle against the tree. On each side of the curve is a pin which is driven into the tree to hold it. These cups are cone shaped, and on this account poor, as the latex coagulates in the point, and is hard to wash out. A round base would be an improvement. A second improvement would be to do away with the pins, make the cup of somewhat stiffer material, sharpen the curved edge, and fasten it to the tree by pushing the edge under the bark. This leaves no space between cup and tree for the latex to run through. The cups now employed can be used this way when the pins come off, as they frequently do, and if they were somewhat stiffer would be all right in that respect. The cups now in use are rather small. Their capacity is about sixty cc., or half a gill. A cup with a capacity of one gill should be sufficient for trees up to nine or ten years old unless the yield increases unexpectedly.

COLLECTING THE SCRAP.—Gathering of latex consists not only of taking what runs into the cup, but also what remains on the tree. The first latex to flow is rather watery, and runs into the cups. This flows only a short time, giving nearly a cupful with the best-yielding six-years-old trees sometimes giving more at the base of the tree. This latex flows slowly and for some time, but has ceased in about fifteen minutes after tapping. This latex can be removed with a spoon or with the fingers. A small amount is always left in the cut which cannot be removed as latex, and when coagulated there is too little of it to be worth removing. The only way to get this latex is not to do any spooning, but to allow the latex to coagulate in the cuts and remove it in a few days. Rubber coagulated in this way is very clean if the trees have not too much moss on them. The objection to this is that if a heavy rain comes before the latex is coagulated it is all lost. It might be a good plan to gather in this manner in the dryer times.

THE MANIPULATION OF THE LATEX OF CASTILLOA.

WASHING.—When the latex is brought in from the field it contains small pieces of bark and moss (also mud in the single incision method) which must be got rid of. The bark and moss can be strained away. A certain amount of the bark, however, is very small and will go through a fine sieve. This bark can be taken out by straining through cheese-cloth, but the cloth does not last long and often breaks through the straining. Practically all the fine bark can be removed in the washing, and so it is not necessary to strain it out. It is hard to strain pure latex, and generally water must be added to it first. It can be strained pure by working it through the sieve with the fingers, but this breaks up the bark, and much more goes through than ordinarily would do so. It might prove desirable not to add any water to the latex during its manipulation, as a small amount of latex is unavoidably lost by washing, but this would not make much difference in only one washing.

Washing when mud is in the latex and when it is not are two different things. The globules of rubber will not rise to the top nearly as quickly when mud is in it as when there is no mud. The first washing takes two or three hours with mud, and about fifteen minutes without. In either case a black water forms and must be run off. There seems to be no limit to the number of times which the latex can be washed and still give a dark-coloured water, but there is a limit to the rising

of the rubber globules. When the latex comes from the tree the rubber globules are in masses. These masses get broken up by the straining, and still further broken up by the washing until by the third washing nearly all the globules are separated. These single globules become water-soaked and get heavier. Each washing settles more slowly. The single globule, being microscopic, cannot be seen, and is lost if widely separated. Sometimes the third washing refuses to settle at all. Besides all these, there is a danger of coagulation if latex is washed too much. The latex behaves very irregularly in this respect. Apparently the temperature affects it as much as anything else. On a warm day it sometimes coagulates at the first washing. The rubber coagulated in this manner forms in a large cake at the top of the washing can, and must be cut up and the water squeezed out by a clothes wringer or rolling pin. This rubber is strong, clean and fairly dry, but is not uniform, and never can be as dry as thinner strips coagulated regularly by the blotter method.

Coagulation can be avoided by washing the latex carefully stirring it pretty often, and not letting it stand long after it has settled. It also might be prevented by the addition of some chemical, such as formaldehyde or ammonia. Formaldehyde is placed in the latex in the field to keep it from coagulating. I have never observed anything which proved that it did this, and I have sometimes seen latex brought in with small pieces of rubber floating in it. All these things go to show that too much washing is bad. Whether the black water is harmful to rubber or not, I cannot determine. Pieces of rubber washed once, twice, and three times all have the same strength, elasticity, and cleanliness from bark. There is a difference in the colour; that washed most being lightest, the unwashed rubber being almost black. There is also a difference in stickiness. Unwashed rubber loses its stickiness if dried long enough. Rubber which is unwashed or washed very slightly resembles most nearly in colour a piece of Ceylon Para.

As stated before, the fine bark can nearly all be got rid of by washing. This is due to the fact that the bark is heavy, and settles in the bottom of the washing can and runs out with the first rush of black water. The latex may be stirred and allowed to settle for a few minutes, and then the first black water be run off, carrying the bark that has settled with it. It is then stirred again, etc., each stirring loosening more bark from the latex and allowing it to settle, until practically all is gone.

COAGULATION—WET AND DRY METHODS.

There appear to me to be two general classes of coagulation, which I call wet coagulation and dry coagulation. Dry coagulation is the taking away of water in some manner, leaving the solid parts of the latex globules, which are nothing more or less than rubber. Wet coagulation is the process of addition of some chemical, or of boiling or some similar method which causes the albumin to coagulate, drawing the latex globules together while still wet. The rubber formed by dry coagulation should be free from moisture, and generally is so, because the rubber is formed when still wet. Unless it is in a thin sheet, however, moisture is shut inside of it where it cannot be easily got out. Wet coagulation has not always this objection, for the methods used in Ceylon would be classed as wet coagulation, and yet they make very good dry rubber.

Of dry coagulation the simplest method is to allow the latex to remain on the tree until coagulated. This makes good rubber, which is pretty clean unless trees have made moss on them. This rubber is not always dry if it rains between the time of coagulation and time of gathering. If allowed to stay on the tree very long it becomes very sticky, which I believe is due to getting wet and drying out again many times. I think this is the reason why people state that sun-dried rubber is sticky. It has been my experience that rubber dried in the sun is not stickier than other rubber if it is not in the sun too

long, when it is likely to be in the rain also. I believe that rubber could be easily sun-dried through glass without its becoming sticky. Another way is to drain off the surplus water and to dry the latex globules remaining until they coagulate. This is the blotting paper method. Blotting paper hastens the draining by soaking up a good deal of water, but there is no reason why this method could not be employed with any other paper through which water would drain, such as chemical filter paper. The question of durability and cost of the papers would come in here. Some objections have been made to the blotting paper on the ground of expense. It is thought that every sheet of rubber means a sheet of blotting paper of the same size. This is not so, as every sheet of blotter will coagulate, eight, ten, or even more sheets of rubber before it is used up. It must be remembered that there are two processes in dry coagulation. First the surplus water drains off and the globules are left; each globule contains water which must be got rid of before coagulation takes place unless the albumins are coagulated, when it becomes a wet coagulation. The blotter will not soak up this water in the globule, but it can be got rid of by slow drying in the air or by artificial heat of the sun's rays. In the case of a porous tile the water is apparently soaked out of the globule immediately the rubber coagulates. I have not examined this rubber microscopically, and cannot be sure that the globules are free from water. Pressure will also take away the water from the globules. Pressing between two blotters makes good rubber, and pressing between two porcelain tiles still better, because the tile is more durable. Another pressure method is to hang the latex up in a cloth bag, allowing all the surplus water to drain off, and then to exert pressure on the outside of the bag. This would not make uniform rubber, and it would be likely to be thick. The objection to blotting paper has been that the paper adheres to the rubber. Most of this can be scrubbed off with a brush, but this necessitates a good deal of labour. However, very little rubber will come off on the paper if it is watched carefully and taken off at the right moment.

COAGULATION BY CHEMICALS AND HEAT.

Wet coagulations are of two sorts: coagulation by chemicals, and coagulation by physical forces, such as heat. In the last category there is only one certain way that I know of, that of boiling. Coagulation by the boiling takes place differently at different times. Sometimes the latex coagulates before reaching the boiling point, and at other times not until the water is half boiled away. What makes this difference I do not know. Boiled rubber is full of moisture, is irregular in shape, and appears to me to be weaker than other rubbers. It appears that the more boiling necessary, the weaker the rubber. I have not been able to coagulate by simply adding boiling water to the latex and leaving it to stand, as Dr. Weber recommended. The coagulation of latex before it is thoroughly washed is probably a heat coagulation. It is possible that cold, vacuum, electricity, etc., might be outside influences that could affect coagulation.

Coagulation by chemicals has some drawbacks. Most chemicals appear to weaken rubber. Chemicals are likely to be costly, and many chemical coagulations are uncertain, and depend on other conditions, such as temperature, age of latex, etc. Latex which has been a day or two out of the trees will coagulate by chemicals much more more quickly than fresh latex.

Alcohol, of all chemicals I have used, makes the strongest rubber, and coagulates the most quickly. It appears to have no other action, and to produce no colour change on the latex or black water. The objection to alcohol is the expense, as the duty on it is heavy. The preparation known as sulpho-naphthol is a quick coagulant, but it takes some quantity of it to coagulate, and it makes

a very weak rubber. The coal-tar which is in it seems to enter into some sort of union with the rubber, making it sticky and destroying its strength and elasticity. If an excess of strong sulpho-naphthol is used, a black pitchy substance with the consistency of chewing-gum is formed.

Acid will coagulate to a certain extent. Sulphuric acid when strong will coagulate immediately; when weak it does not coagulate at all. Rubber coagulated by it is generally weak in proportion to the strength of the acid. Even the strongest rubber formed by this means is eaten on the surface. Limejuice will coagulate under certain conditions, but just what these conditions are I do not know. I have not been able to coagulate by any other acids. No other chemicals that I know of give certain coagulations.

Sodium carbonate and calcium chloride have coagulated on certain occasions, but this could not be repeated. There appears to be sometimes a sort of half-coagulation. The latex rises to the surface, forming a thick sheet which cannot be blown apart like ordinary latex, but which is not sufficiently solid to pick up. This half-coagulation is affected by weak solutions of acid; sulphuric, hydrochloric, nitric and lime juice; by calcium chloride, sodium hydroxide, and sodium carbonate. No matter how long such latex stands, it will not become rubber until something further is done to it. On the whole, dry coagulation is better than wet. I am of opinion that the best coagulation will be found to be pressure between porous tiles. This would make dry uniform rubber. It could be done mechanically, and the tile could be made so as to print a plantation name or letter on the rubber. —*The Quarterly Journal, Liverpool. Institute of Tropical Research.*

(*To be concluded.*)

Notes on the Cultivation and Manufacture of Rubber.

OBSERVATIONS IN THE MALAY PENINSULA.

Planting.—Even taking into consideration the increased expense, baskets are distinctly preferable to stumps.

Distances for Planting.—Opinion still varies greatly as to what is the best distance to plant. Observations made on some of the principal estates on the Malay Peninsula lead to the belief that anything less than 100 trees to the acre is an extravagance, which present experience does not warrant. Anything more than 400 to the acre has not been attempted so far as is known, though the gardens at Singapore may be quoted as an exception.

It remains to be proved whether or no close planting will ultimately give a larger yield per acre than wide. That the yield will be largely in favour of close planting during the first two or three years of tapping there can be no doubt, but how long this advantage will last has yet to be ascertained. It has been advocated that the trees should be planted close at first and subsequently thinned; though it is open to doubt if in the case of a field planted, say 10 x 10 ft., and thinned to 20 x 20 ft., the yield after the thinning will ever be as good as that from a field planted at the wider distance.

In view of the percentage of trees of comparatively poor growth that occurs under all systems of planting, it seems advisable to plant at first such a number as will provide a margin sufficient to maintain the number of trees to the acre at not less than that desired when these failures have been cut out. In cases where wide planting has been supplemented at a later date by intermediate rows of trees, these appear to have universally failed.

Everything considered it would seem 30 x 10 ft., representing about 144 trees to the acre, is the distance which offers the greatest advantages, giving as it does a sufficient margin for cutting out a few weak trees, while the 30 feet between the

rows should give them all the space they are likely to need, and when the trees are tapped is a more convenient arrangement than one where they are further apart in the rows.

Soil and Drainage.—Experience has not as yet taught us what soil or situation best suits the *Hevea Brasiliensis* both with respect to growth and yield of latex. Undoubtedly the most rapid growth of young trees is to be found on the alluvial lands of the Peninsula. That this advantage will be permanently maintained we have no proof. On the other hand, it may be found that the higher land where the roots can go down to a greater depth—a tap-root being the *Hevea's* most characteristic point—will compensate the tree for the poorer quality of the soil by affording it a much larger cubic space to draw upon. Since in the alluvial land the tree frequently reaches water at a depth of two or three feet, while in the higher land unlimited depth is available, every foot by which the mean water level is lowered gives 400 additional cubic feet of feeding space to each tree, supposing them planted 20 x 20 feet.

Cultivation.—There is a very wide difference of opinion with regard to the mode of cultivation, many people preferring to have no other crop on the ground with the rubber, while others consider that such a sacrifice, where a catch crop is remunerative is not warranted by the advantage that may possibly accrue to the rubber.

Coffee, tapioca and sugar represent the three principal catch crops in use in the peninsula ; and in almost all cases where they occur, the land has been under that cultivation before the rubber was planted. The two latter have been made the object of much undeserved abuse, chiefly at the hands of people who have had no experience of them. Any damage the trees may suffer may with certainty be attributed to want of care in the methods of cultivation required by these crops, rather than to any loss the soil may suffer by their presence, while the thorough tillage incidental to their cultivation must be of great benefit to the soil. Numerous other catch crops are to be seen, but only on a small scale, and in no instance do the rubber trees appear to be harmed by their presence.

Where there is no catch crop, there is also a difference of opinion as to the advisability of keeping the ground absolutely clean or otherwise. Where jungle has been felled for planting rubber, it is no doubt an economy never to let weeds or grass take firm hold ; but in the case of land already under grass, no harm can be done —provided that a space near the root of the tree be kept clear and the whole occasionally mown down by the scythe, and in this way even Lalang will die out when the trees shade the ground.

Pruning, &c.—As yet very little has been done in this direction, but it would seem from experiments made recently that trees topped at the age of about nine months show a marked advantage over trees that have not been so treated.

Tapping.—There is still a lack of knowledge and diversity of practice with regard to tapping throughout the day as against morning and evening only. It may be found that the loss that is undoubtedly sustained by the former practice is counterbalanced by its convenience.

As regards the methods of tapping there seems to be a consensus of opinion, and rightly so, that the half herring-bone is best for the tree and most convenient for the tapper, and in all probability this method will be generally adopted.

As to the age when tapping should begin there is no hard-and-fast rule, but when the trees have a girth of 20 inches at 3 feet from the ground there is not the slighest reason to delay the extraction of whatever latex they will yield by judicious tapping. It is a fallacy to delay tapping after trees have attained that girth, on the score of their being too young, and much valuable rubber throughout

the Malay Peninsula is being left ungathered for that reason, as also in many instances for want of experienced labour for tapping. This loss will in no way be compensated for by any superiority in yield in the future of the trees left untapped; rather the contrary.

Manufacture.—As in everything connected with the cultivation of the rubber tree there is still much to be learned in the conversion of latex into dry rubber. Much has been done during the last two years in this direction, but there is no doubt that as yet plantation rubber does not attain the standard of strength set by the wild product. This may be entirely accounted for by the youth of the trees; but, on the other hand, the method of curing may be partially to blame and no way has as yet been found of in any way impregnating the latex with an antiseptic agent to obtain the results attained in the case of the wild Para by the use of the smoke of the manioc nut.

Drying.—It seems certain that with an atmosphere which, as a rule, so nearly approaches saturation, drying without artificial aid can never be satisfactory —on the other hand, anything much over 110 Fahrenheit must be regarded as dangerous to the rubber—which leaves us very small scope for increasing the moisture-absorbing power of the air by heating it. Drying the rubber by means of Calcium Chloride does not seem a satisfactory solution. What is wanted, it would seem, is some process—both continuous and efficient—of drying the rubber at a moderate temperature.

Another point, wherein the planters are at a great advantage, is that there is no standard or test for their product which they can apply. The buyers are understood to price the rubber simply by its appearance and feel, and to pay no attention to any test or analysis that may be put before them. If there was some standard of strength or elasticity for the rubber, the planters would have something to which they could work.

J. F. R.

Penang, 15th May, 1906.

THE EXPORTATION AND PACKING OF HEVEA SEEDS.

Under this heading some notes have been published in the "Journal d'Agriculture Tropicale" by Monsieur Ulysse Bernard. On account of the fine quality of the rubber from *Hevea brasiliensis* it is not surprising, he remarks, that those countries owning colonies sufficiently hot and moist for the cultivation of the tree have made numerous efforts to take away Brazil's monopoly of the production which that country has held up to the present.

Two factors, however, prevent the rapid extension of *Hevea* cultivation in the colonies; one is the difficulty foreign countries have in procuring *Hevea* seeds (Brazil having interdicted the export of plants and seeds from the country); the other is the ease with which the seeds lose their germinating powers when long distance transport is necessary.

PROHIBITIVE DUTY ON CEYLON SEED.

The writer then refers to the suggested prohibitive export duty on rubber seeds in Ceylon and the Malay States, which happily was not carried through, and proceeds :—

This project is now a dead letter, the Government not approving of the proposition of the planters. We know that the English Government in general has a certain repugnance to such prohibitive taxes which never succeed in preventing the propagation of any cultivation while constituting a very great inconvenience to the commercial transactions of the country. Besides, it seems

—according to Berkhout—that Brazil is thinking of withdrawing the prohibitive export duties which were levied on Para seed; which indeed have only succeeded in losing for them the price of the seed sold by the English while the cultivation has developed just the same. Further, by the mere fact of this exaggerated protection a dangerous illusion of a non-existent security has been given to the people, while in reality the Far East has become a terrible menace to the future rubber export industry of Brazil. There may well be in Brazil a repetition of what occurred in the South America Republics in connection with quinine; the formal prohibition did not prevent the secret export of seeds which were the origin of the magnificent cultivations in Java, which, after a short time, have ruined the exploitation of the tree in its native countries.

DIFFICULTIES IN SEED TRANSPORT.

We have said that the germination of *Hevea* seeds, after a long voyage, presents numerous deceptions. The Dutch East Indies have had experience of this. In September, 1904, 50,000 *Hevea* seeds were ordered from Ceylon by the Forest Department; not a single seed germinated. An identical result followed an order for 25,000 seeds made on a plantation in the island of Malacca by Dr. Treub, of the Buitenzorg garden, now Director of Agriculture of the Dutch Indies.

During last year M. Van Den Bussche was commissioned by the Dutch Government to proceed to the Malay States for the purpose of studying the cultivation of the *Hevea*. Previous to his departure M. Berkhout had asked him to send him *Hevea* seed packed in different ways and to try, besides, the effect of an anesthetic such as ether on preserving the germinative faculty. To obtain the same results benzine was substituted for ether, and this had the effect of burning the seeds; none of those which came in contact with the benzine germinated.

A package despatched from Penang on September 18, 1905, arrived on November 1st at Wageningen (Holland) the seat of the Colonial School of Agriculture at which M. Berkhout occupies one of the principal chairs. The seeds were packed as follows:—

Nos. 1 and 2, wood charcoal soaked with benzine.
No. 3. wood charcoal not soaked with benzine.
No. 4, dried leaves.
No. 5, seeds dried very carefully and packed in sand.
No. 6, wood sawdust.
No. 7, wood sawdust soaked with benzine.

The seeds were sown, on arrival, in a small bed traversed by the pipes which heated the green-house, which produced a uniform and sustained degree of heat; the seeds were covered with 1cm 5, of sand to give them sufficient moisture.

They were examined every two days, and as they germinated were transplanted into small pots. The following table shows the observations made during the course of the germination, from 1st to 27th November. The result was a total of 63 germinations out of 189 seeds sown, making 33 per cent; the rates of partial success given by each kind of packing were:—

No. 1 and 2	nil	No. 5	46%
No. 3	66%	No. 6	25%
No. 4	46%	No. 7	nil

This indicates that packing in dry layers may give satisfactory results if the transport does not exceed a longer period than 6 weeks. For a voyage of much longer duration packing in a moist medium will be preferable; in this case the seeds must not be too tightly packed so that the rootlets may not get interlaced and so be broken when taken out for the seed bed.

The price of Hevea seed has gone up considerably during late years, and in Ceylon last year went up to R35 per 1,000. On the other hand according to Mr. Van Den Bussche, the price in the F.M.S. was 11.5 florins (24 francs) per 1,000, that is much less than in Ceylon. When it is realised that one rubber plantation in the Malay States has sold 1,000,000 seeds to a single German Company it can be calculated of what great importance to the English planters the sale of their seed is, and the economic danger that would be offered them if a prohibitive export duty were levied.—*Translated from the French.*

Kinds of Rubber.

PLANTATION RUBBER IN CEYLON AND AMERICA.

Ceylon, thanks to the excellence of the work of its Scientific Department and the character and enterprise of the planters, is held as an example for tropical planting throughout the world. In the latest planting product, rubber, the Ceylon industry is the world's criterion, and yet there is much that Ceylon may learn from other countries in connection with the industry, and information of what men in other lands are doing is always of service to planters of this Colony. We need, therefore, put forth no other reason for having accorded considerable space during the past week to the subject of Castilloa rubber cultivation in Nicaragua. The writer of that article put forth a number of original views and had evidently studied the subject carefully ; and not the least interesting paragraphs were those in which he compared the *Castiloa elastica* with *Hevea brasiliensis*, preferring the former, at all events for cultivation in Central America.

In Mexico considerable planting is going on as we have pointed out on several occasions. Today, by courtesy of a Colombo gentleman, we have before us a report on the La Junta plantation of the Mexican Mutual Planters' Co. This is the report on the estate to the shareholders by Dr. Henkel and Mr. Augustus Curtis, who were elected at a meeting of the shareholders to visit the place and report. The report is a handsomely got up booklet, 10 by 8 in., containing a number of plates from photographs taken on the property, which seems to be a flourishing and very promising concern. *Castilloa elastica* is the cultivated tree, and the conditions of growth and cultivation there are utterly different from the East. From figures given they have some 700 trees per acre. In 1905 the seed for planting was thought to be poor, and over the 741 acres then planted " as an extra precaution six seeds were planted at each stake instead of the usual four. . . . . The vast surplusage of plants is available for us elsewhere on the property or for sale." The Company started planting in 1901 when 455 acres were planted, and they have gone on each year, 851 acres being put out in 1904 and 741 in 1905, and now the total acreage under rubber is 3,298 acres ! Besides this the Company has over 450 acres in coffee and 249 in cacao. The growth of the rubber seems excellent, although the girth is not so great as might be expected ; this is owing probably to the close planting adopted. Trees 4½ years old, of an average height of 20 ft., girth 11 6-10 inches ; and ten trees near the road averaged 14 inches ; while ten others along a road averaged 13 7-10 inches in girth. Young seedlings seem to grow rapidly, those of 7 months being as high as a man's shoulder and well covered with foliage. But when it comes to cost of labour, we notice an immense difference between Mexico and Ceylon. There they pay 1½ dollar Mexican per day, or the equivalent of 75 cts. gold American, which is over Rs. 2·20 ; and even at this high rate they only work for a task which takes the best men from 1 to 3 o'clock in the afternoon. This is not mentioned in the report under notice, but the information is given to us, and

our correspondent remarks :—" Yet they expect, as you will see, to pay £25 an acre profit"! Nothing like this elegant report is produced by Ceylon Planting Companies, for no extra enticement is needed to draw capital to Ceylon and the East; and if these expectations come to pass, the assurance for Ceylon is all the greater.

As regards up-to-date information of Ceylon methods we need only refer the reader to the important interview with Mr. Herbert Wright recorded in our columns yesterday; where the latest details are given of the use of single and—for the first time—of multiple drip tins, economic tapping, and the quality and yield of rubber from high parts of trees.

Today we publish an interesting article* giving an epitome of rubber cultivation in the Malay Peninsula. The writer takes a very keen interest in everything connected with rubber, and he has a larger interest in the industry than perhaps any individual proprietor in the Malay Peninsula. His remarks are concise and to the point, and will be read with interest by planters.—*Ceylon Observer.*

The World's Rubber.

RUBBER IN THE MALAY PENINSULA.

Mr. A. O. Devitt, who is known to the majority of rubber planters in Ceylon, through his lengthy visit to the Colony recently, has put in a couple of days here on his return from the Malay Peninsula homeward bound. From what he had heard previous to his visit Mr. Devitt had expected great things of the F. M. S., and was a little disappointed. Rubber, he says, is grown there to a larger extent than in Ceylon; that is, you see greater continuous blocks of rubber trees and larger clearings, but Ceylon need not fear competition; there are certain advantages over there, but these are counter-balanced by certain disadvantages; certainly in the Peninsula things are being done on a large scale.

Large individual estates are able to turn out big lots of rubber of the same quality and grade and similar in appearance; whereas, in dealing with Ceylon rubber, to get a large stock together of similar rubber it has to be made up with samples from all over the place. This, of course, is merely a matter for time to make good for Ceylon.

On the majority of plantations washing machines are employed and crêpe rubber turned out. One of the specially interesting observation Mr. Devitt made was that on so many estates the parings or shavings taken off in tapping are collected and put through the rollers of the washing machine, and that this operation pays for the tapping!

"On a great many estates they pay for the entire tapping by putting the parings through the crêpe machine rollers," he says. Even on the best tapped trees, Mr. Devitt remarks, some rubber will be found on the shavings, not *in* the shavings, but sticking to them either as small scrap or drops which have oozed out, after the latex has ceased to run, and all these should be saved, passed through the machine and turned out as crêpe. It is quite unnecessary, says Mr. Devitt, when shipping the rubber to mention that it is scrap from shavings; but the crêpe should be piled in lots according to colour as pale, dark or darkish, and black crêpe. Mr. Devitt highly recommends this method of treating the shavings from the tapping operations to all Ceylon planters as an economic operation. Sheet rubber is, however, still the more attractive form in which to make it. It looks very strong and well coloured and is very attractive to buyers; and run through the rollers with water playing on it, as is done on Lowlands and some other estates, the sheet turned out is excellent.

---

* See "*T.A.*" this month, page 22.

"The growth of the trees out there is in many cases a year ahead of Ceylon; but in my opinion," Mr. Devitt remarks, "after the first year of tapping there is very little difference in the yield of the trees, but I have no statistics to go upon. It is in getting the trees into bearing a year younger that they have the pull over there. But I saw many instances of backward trees (in girth) giving more rubber than surrounding trees that had gone ahead."

Herring-bone tapping seemed to be the favourite method of extracting latex. While talking on this subject of tapping mention was made of the Seremban estate, which has been under a bit of a cloud lately. The estate is now evidently under the right man in Mr. Mansergh, and we are pleased to hear that he will no doubt give the directors a different story to tell at the next annual meeting. "Under great difficulties," Mr. Devitt remarks, "through mutilation of the trees in tapping, he has put the first series of new cuts on most successfully; and I think that after the first two or three months of tapping they will get into order and the trees give as good yields as any others properly tapped from the beginning. The rubber turned out is of excellent quality and should hold its own with the best marks on the market. Mr. Mansergh has a tight hand on the coolies who are shaping well under him and the labour difficulty should now be at an end."

Mr. Devitt went through a large part of the Malay Peninsula, but unfortunately was prevented by the quaratine regulations, owing to the cholera outbreak, from visiting certain estates he would like to have seen in Perak, Province Wellesley, etc.

The Bukit Asahan estate was among those he visited. The estate was somewhat famous recently on account of the bad report on it published in its prospectus; that report, Mr. Devitt thinks, was very hard on the estate. Mr. P. J. Burgess in now pulling the place round, and under European control a very appreciable difference is already seen in the working of the estate, and it should prove a fine paying property.

Johore State pleased Mr. Devitt greatly. He thinks it a most promising district with a beautiful soil. Lavadron estate is a very good example of what can be done there.

At Singapore Mr. Devitt visited the Botanical Gardens but was disappointed to miss Mr. H. N. Ridley there. On Jugra estate he saw a plantation of the finest coconuts he has seen, showing immense growth, and the success is encouraging further planting of this product, which from all accounts should pay well.

MOISTURE IN RUBBER.

Regarding the recent letter to the *Ceylon Observer* on the marketing of Ceylon rubber in a moist condition from Messrs. Lewis & Peat, (see *T.A.*, May, 1905, page 272) Mr. Devitt says the opinions in that letter were given as those of a private individual —not those of the firm. Messrs. Lewis & Peat's desire was to have the matter brought to the notice of planters and discussed, with a view to finding out the best method of curing the rubber and marketing it; and in this their letter was very successful.

"We know," says Mr. Devitt, "that Brazil Para Rubber will keep good for 60 years, whereas Ceylon will not keep like that; and we want to find out why it is, and how its qualities can be improved upon, and to get the planters to adopt the best method of curing and packing."

THE INDUSTRIAL DEMAND.

POSSIBLE EFFECTS UPON THE RUBBER PLANTING BUSINESS.

The question as to whether plantation rubber companies are likely to suffer from the evils attendant on the over-production of the commodity is one which has been incidental referred to in these columns during the past few months. It has been pointed out that so long as the world's consumption of rubber is more than equal to the available supply there is very little danger of any material falling off in the market prices which the commodity consistently commands in London and other centres. But this very demand and the consequent high price of the better-grade rubber make it possible for the wild rubber collector to compete, and compete successfully, with the plantation owner. As our readers are by this time aware, the present margin of profit to the planter is a very considerable one, and even when an extravagant allowance for working expenses and interest upon capital has been made, this profit is anything between 3*s*. and 4*s*. per pound. The wild rubber collectors or middlemen agencies, on the other hand, can never hope to keep their expenses down to the same equal level as the planter. The latter, as a matter of fact, can reasonably hope to make considerable reductions under this heading as years go on, and the use of machinery adapted to the rapid curing of the latex becomes more general. Those interested in the collection of wild rubber, on the other hand, have to face the fact that year after year greater distances have to be travelled to obtain sufficient supplies to make their industry a profitable one, while they also know that the manufacturer who must use rubber in his business prefers (other things being equal) to pay a slightly higher price for plantation rubber owing to its greater purity. The best grade Para, from the Middle East, may be said to average over 95 per cent. pure rubber; the best grades from the Amazon work out at something like 83 per cent. of pure rubber. The difference in these percentages is practically represented by the difference between the prices in the world's markets, and goes far to confirm the contention that the manufacturer prefers and will naturally support the product of the plantations, provided he can be reasonably sure of obtaining fairly continuous supplies.

This, as we all know, will be the case in a very few years' time. But provided something resembling the present prices obtain it will still pay to collect wild rubber, so that the manufacturer will be able at least to await the most favourable markets (from his standpoint), and not be compelled, as he is at present, to buy in an almost hand-to-mouth fashion. But there is no reason to believe that the market will be glutted with rubber in the not far distant future.

For not only are the recognised rubber industries using more and more of the commodity every year, but there are many others which, apart altogether from the selling price of rubber, are languishing or are being neglected simply on account of the uncertainty of the supply. There are also still further industries which are at the moment non-existent, but which, were rubber to cheapen in price, would speedily become large and steady consumers. This is a point which those about to embark in rubber plantation exploitation might do well to bear in mind. For although there is no reason to anticipate any marked decline in the market price for years to come, yet the period must arrive when the price will react in obedience to the law of supply and demand. At the present moment, were plantation rubber fetching only, say, 4*s*. per lb., and the supply from such sources fairly large, much of the wild rubber which is now being marketed at a profit would not be collected at all, or, if so, at very little profit.

No one anticipates that the six-shilling level for plantation rubber will be maintained for an indefinite period, but, on the other hand, when the supply

from such sources has materially increased the price is bound to react. If a planter only obtained 2*s*. per lb. for his rubber he would still be making a very respectable profit, while, with the exception of some very low grades, wild rubber would not pay to collect at such a selling price. It will be seen, therefore, that whatever happens, the planter will be practically master of the situation, and that even if the world's output were to be increased to say, 100,000 tons per annum. For he has not only the certainty of a sure market for as much as he and his neighbours can produce each year, but he can, by agreeing to accept a low, though to him still profitable, price for his product, squeeze the wild rubber out of competition with himself.

It has not been necessary for the planter, as yet, to look so far ahead and to study the possibilities of the market, say ten years hence. But the manufacturers and users of the material are, it would seem, quite alive to these possibilities, and as many of the articles they produce are more or less necessities for the richer section of the community, they fancy that they will always be in a position to prevent anything resembling a corner in rubber. In other words, they can, by bidding prices for wild rubber of the better grades which enables that commodity to be collected at a profit, practically guarantee themselves with assured supplies, equal at least to their ordinary requirements—and the actual consumers of the products of their factories will have to pay the price. That it will ever be necessary to face such a contingency is deciedly questionable. For one thing, the danger of any combine among the world's rubber plantation owners to squeeze out the wild rubber collectors by reducing the price of the commodity is quite outside the range of practical commercial politics.

At the same time, in the years to come the supply from the rubber plantations might easily equal, and possibly overtake, the world's consumption, and then prices for this commodity would inevitably fall, and possibly fall to the level when it would be impossible to market wild rubber at a profit. But the manufacturers would not suffer—indeed, they would be the gainers, since they would obtain what is admittedly a better article than the wild product at a figure possibly much below that which obtains at the moment for low-grade wild rubber, and at the same time the plantations would not be worked at a loss.

One or two manufacturers of rubber seem to incline to the belief that in the comparatively near future rubber will be selling in the market at considerably below current quotations. But there is nothing to warrant such an assumption, any more than there is anything to lead to the belief that the price will go higher either from natural causes or from the operations of any corner. Well-informed men in this business incline to the opinion that for some years to come, even with materially increased supplies, the price will fluctuate within narrow limits round the current quotations, and that unless marked improvements take place in the preparation of wild rubber for the market, this article will be gradually ousted by the better and purer qualities obtainable from the plantations. It would seem, then, that while the manufacturers of rubber are not likely to suffer any hardships through scarcity of supplies or dearness in price, neither are the planters to toil without a sufficient reward for their labours. The folk who may suffer—and even this, be it noted, is by no means more than a mere possibility—are those interested in the collection of wild rubber, especially when great distances have to be travelled, in the first instance, and the entrepots are far removed from the manufacturing centres of the world.—*Financier*.

THE LONDON RUBBER MARKET.

LONDON, May 11th, 1906.—At to-day's auction, 342 packages of Ceylon and Straits Settlements Plantation grown rubber were under offer. The total weight amounted to about 15 tons, Ceylon contributing 3 and Straits Settlements 12. Though this was a large offering which included several attractive parcels of fine quality sheet and biscuits, orders were rather scarce, and consequently prices marked some irregularity. Where sales were effected, the price generally realised for fine biscuits and sheet was 6*s*. 1½*d*., but several parcels were withdrawn from sale for lack of support. For scrap grades also competition was less animated than at the last auction, though for the finer qualities about last rates were obtained. There was a large consignment of fine sheet and other grades from Bukit Rajah amounting to 2¼ tons, and the finer qualities met with good attention, realising up to 6*s*. 2¼*d*. per lb. Owing to the increase in the size of the sales lately, it has been decided in the interests of the trade generally, that the auctions shall in future be held at the Commercial Sale Rooms, and this new arrangement was inaugurated to-day. Quotations for Plantation Biscuits and Sheet to-day.—6*s*. 1½*d*. to 6*s*. 2¼d., same period last year, 6*s*. 6½*d*. to 6*s*. 8½*d*. Plantation Scrap.—4*s*. to 5*s*. 3½*d*., same period last year, 4*s*. 6*d*. to 5*s*. Fine Hard Para (South American).—5*s*. 3½*d*., same period last year, 5*s*. 7¾*d*. Average price of Ceylon and Straits Settlements Plantation Rubber.—212 packages at 5s. 9¼*d*. per lb., against 227 packages at 5*s*. 11¼*d*. per lb. at last auction.

Particulars and prices as follows :—

CEYLON.

MARK.	QUANTITY, DESCRIPTION AND PRICE PER LB.
Culloden	6 cases darkish pressed crêpe, 6*s*. 1½*d*.; 2 cases dark, 5*s*.
F.B.	1 do scrap and pieces, 4*s*. 6*d*.
Tallagalla	1 do fine darkish biscuits, 6*s*. 1½*d*.; 1 case fine scrap, 5*s*. 3½*d*.; 2 cases dark low scrap, 2*s*.
Warriapolla	4 do fine very pale to darkish biscuits, 6*s*. 1½*d*.; 1 case darker, 6*s*. 1½*d*.; 1 case good scrap 5*s*. 3½*d*.
Gikiyanakande	2 do fine pale worm, 6*s*. 2*d*.; 2 cases fine darkish crêpe, 5*s*. 11*d*.; 1 case dark, 5*s*.
Densworth	3 do fine darkish biscuits, 6*s*. 1½*d*.; 1 case darker, 6*s*. 1½*d*.; 1 case fine palish scrap, 5*s*. 3½*d*.
Doranakande	2 do dark cloudy biscuits, 6*s*. 1½*d*.; 1 case rough sheet, 5*s*. 10*d*.; 2 cases fine palish scrap, 5*s*. 3¾*d*.; 1 case good dark scrap, 4*s*. 9*d*.
Ambatenne	2 do fine palish biscuits, 6*s*. 1¾*d*.; 2 cases dark biscuits, 6*s*. 1¾*d*.; 1 case dark biscuits (mouldy), 6*s*.; 2 cases pieces, 5*s*. 6*d*.; 1 do good pale scrap, 5*s*. 3½*d*.; 1 case darker, 5*s*. 3½*d*.; 1 bag dark 5*s*. 3½*d*.; 1 case dark pressed, 4*s*.
Duckwari	1 do fine pale to dark biscuits, 6*s*. 1½*d*.; 1 bag fine pale scrap, 4*s*. 8*d*.; 1 package good rejected biscuits, 4*s*. 8*d*.
Halgolle	1 do palish mixed scrap, 4*s*. 6*d*.

STRAITS SETTLEMENTS.

Jebong	1 case scrappy sheet, 5*s*. 0¾*d*.; 1 case fine scrap, 5*s*. 3½*d*.
G.M. S.B.	1 do fine pale scrap, 5*s*. 2½*d*.; 1 case pressed scrappy sheet, 4*s*. 8½*d*.
K.K.	1 do fine pale sheet, 6*s*. 1½*d*.; 1 case fine Rambong ball, 4*s*. 3½*d*.; 1 box scrap, etc., 4*s*. 9*d*.
Beverlac	4 do fine dark biscuits, 6*s*. 1½*d*. bid.; 8 cases fine dark sheet, 6*s*. 1½*d*. bid.; 1 case sheet, 6*s*. 1½*d*. bid.; 14 cases fine palish to darkish sheet, 6*s*. 1½*d*. bid.; 6 cases darkish cloudy biscuits, 6*s*. 1½*d*. bid.

MARK.	QUANTITY, DESCRIPTION AND PRICE PER LB.
P.S. P.R.	12 cases fine pale crêpe, 6*s.* 2*d.*; 1 case fine palish crêpe, 6*s.*
Highland	7 do fine palish crêpe, 5*s.* 11½*d.*; 8 cases darkish, 5*s.* 1¾*d.*; 4 cases dark, brownish, 5*s.* 3¼*d.*
B. (in diamond)	1 do good rejections, 4*s.* 10½*d.*; 9 cases scrappy sheet, etc., 5*s* 1*d.*; 4 cases sheet, 5*s.* 1½*d.*
L.E.A.	7 do fine pale crêpe, 6*s.* 2¼*d.*
L.E.B.	1 do fine scrap, 5*s.* 0½*d.*; 1 case rejected biscuits, etc., 5*s.* 1½*d.*
L. E. (Muar in triangle) Straits	8 do fine pale ribbon, 6*s.* 2*d.*; 1 case dark, 5*s.* 3*d.*; 1 case darker, 5*s.* 5*d.*
W. P. M.	4 do fine amber sheet, 6*s.* 1½*d.*; 2 cases darker, 6*s.* 1½*d.*; 2 cases fine palish scrap, 5*s.* 3½*d.*
Tiger Asahan	4 do fine amber biscuits, 6*s.* 1½*d.*; 4 cases dark biscuits, 6*s.* 1½*d.*
Bukit Lintang	4 do fine palish biscuits, 6*s.* 1½*d.*
D.W.H.S.	2 do fine darkish washed sheet, 6*s.* 1½*d.*; 1 case good palish to dark washed sheet, 6*s.* 1½*d.*
B.R.R. Co., Ltd.	29 do very fine large amber sheet, 6*s.* 2*d.* to 6*s.* 2¼*d.*; 6 cases little darker, 6*s.* 1½*d.* to 6*s.* 1¾*d.*; 7 cases paler bubbled, 6*s.* 1*d.*; 5 cases good darkish scrappy sheet, 5*s.* 3½*d.*; 9 cases good scrap, 5*s.* 1*d.* to 5*s.* 3½*d.*; 1 case good rejections, 5*s.* 3½*d.*; 3 cases good cuttings, 5*s.* 4½*d.*; 4 cases fine sheet rejections, 5*s.* 10*d.*; 2 cases good scrap, 5*s.* 2*d.*

LONDON, May 25th.—At to-days auction, 159 packages of Ceylon and Straits Settlements Plantation grown rubber were under offer. The total weight amounted to nearly 10 tons, Ceylon contributing nearly 1 and Straits Settlements 8½. Since the last auction the market has maintained the quiet tone then prevailing, and except for fine biscuit and sheet qualities, demand was not very keen, and consequently the scrap grades were in many cases somewhat neglected, and here and there showed a decline on last rates. The bulk of the offerings was from the Straits and included one or two large invoices. Amogst these were several parcels of crêpe, and the darker lots proved difficult to quit, buyers being prejudiced against the darker colours. For fine pale crêpe, however, there is a strong demand, and a parcel of this to-day realised ½*d.* per lb. more than fine sheet. A small lot of very fine pressed worm rubber was also keenly competed for and sold at 6*s.* 2¼*d.* per lb. Quotations for Plantation Biscuits and Sheet to-day.—6*s.* 1*d.* to 6*s.* 1½*d.*, same period last year, 6*s.* 5*d.* to 6*s.* 9¾*d.* Plantation Scrap.—4*s.* to 5*s.* 3*d.*, same period last year, 4*s.* 6*d.* to 5*s.* 5*d.* Fine Hard Para (South American).—5*s.* 3¼*d.*, same period last year, 5*s.* 8½*d.* Average price of Ceylon and Straits Settlements Plantation Rubber.—106 packages at 5*s.* 9½*d.* per lb., against 212 packages at 5*s.* 9¼*d.* per lb. at last auction.

Particulars and prices as follows :—

CEYLON.

MARK.	QUANTITY, DESCRIPTION AND PRICE PER LB.
Gikiyanakande	2 cases fine palish rolled crêpe, 5*s.* 6¼*d.*
Ambatenne	2 do good dark cloudy biscuits, 6*s.* 1*d.*; 1 bag rougher, 6*s.* 1*d.*
S. A. (M. M. in estate mark)	1 do small palish Ceara biscuits, 6*s.* 1*d.*
Rangbodde	1 do exceptionally fine very pale biscuits, 6*s.* 1½*d.*
F.J.W.	2 do fine pale pressed worm, 6*s.* 2¼*d.*
O. B. E. C. (in diamond) Kondegalla	4 do fine amber sheet, 6*s.* 1*d.*; 1 case scrappy sheet, 5*s.*
New Rasagalla	1 do fine large palish to dark biscuits, 6*s.* 1*d.*
Hapugastenne	2 do good palish to dark biscuits, 6*s.* 1*d.*; 1 case good pale to darkish scrap, 5*s.* 2½*d.*
D. (in diamond)	1 do small palish biscuits, heated, 5*s.* 6*d.*; 1 bag small lumps, 4*s*

STRAITS SETTLEMENTS.

MARK.	QUANTITY, DESCRIPTION AND PRICE PER LB,
P.R. (in triangle) H.	2 cases scrappy sheet, 5*s.* 1*d.*; 1 bag pale scrappy sheet, 5*s.* 0¼*d.*; 1 csase palish sciap, 4*s.*
M.I. (in diamond)	2 do fine large palish to dark biscuits, 6*s.* 1*d.*; 1 case fine pale scrap, 5*s.* 3¼*d.*
B.L.C.	1 do rough palish to dark crêpe, 5*s.*
L. E. (Muar in triangle) Straits	8 do fine pale crêpe, 6*s.* 1½*d.*; 1 case good darkish crêpe, 5*s.* 3*d.*; 1 case dark, 5*s.*
P.S.E. (in diamond)	2 do good amber sheet, 6*s.* 1*d.*
T.O.P.	1 do good rough sheet, 6*s.* 1*d.*
C. R. (R. W. and Co. in triangle) E.	12 do fine amber sheet, 6*s.* 1*d.*; 2 cases good darkish scrap, 4*s.* 8½*d.*; 1 case dark scrap and pieces, 5*s.*
V.R.Co.Ltd. Klang F.M.S. (in triangle)	21 do fine washed scored sheet, 6*s.* 1*d.*
Gula (in diamond)	1 do good rough sheet, 6*s.* 1*d.*; 1 case pressed scrappy sheet, 5*s.* 2¼*d.*
S. R.C. (in triangle)	9 do good palish to darkish crêpe, 5*s.* 6¾*d.*
P.R. S.B.	6 do fine large amber sheet, 6*s.* 1*d.*; 2 cases darkish scrap, 4*s.* 8*d.*; 1 case pressed scrappy sheet, 4*s.* 7½*d.*
G.M. S.B.	4 do scrappy sheet and scrap, 4*s.* 10*d.*; 1 case fine amber sheet, 6*s.* 1*d.*; 1 case fine palish scrap, 5*s.* 3*d.*
K. M. (in diamond) P.R.	1 case rough sheet, part uncured, 5*s.* 4*d.*
S. (in diamond) S.R.	1 do low scrap, 3*s.*

W. J. & H. THOMPSON.

CREPE RUBBER IN THE LONDON MARKET.

LONDON, May 25th.—Since our last there has been a fair demand for Plantation sorts and sales have been made at 6*s.* 1*d.* to 6*s.* 2*d.* for both pancakes and crêpe. We are glad to notice more inclination on the part of buyers to take crêpe and lace, and there is no doubt plantation biscuits and sheets, as well as crêpe are being taken, although in small lots, by fresh buyers who have not tried it before, as well as by those who have already tried it and are now using it regularly for various and sundry purposes, which is decidedly enacouraging. Parcels were offered at auctions today, amounting to about 8½ tons Straits and Malay States; and only about 13 cwts, of Ceylon.

LEWIS & PEAT.

LONDON, 25th May, 1906.—Plantation Ceylon—25 cases (1 ton) offered and sold, fine biscuits 6s. 1d. to 6s. 1½d., fine pale worms 6s. 2¼d., fine scrap 5s. 1d. to 5s. 2½d., good 5s. 0¼d., ordinary 4s., fair crepe 5s. 6¼d., common dark 4s. Straits—134 cases (8½ tons) offered and 78 sold, fine biscuit and sheet 6s. 1d., fine crepe 6s. 1½d., fair 5s. 3d., ordinary dark 5s., common 4s., fine scrap 5s. 2¼d. to 5s. 3¼d., good 4s. 8d. to 5s., common dark 3s. Next Public Auction will be held on 8th June.

CEYLON.

Ambatenne	3 cases fine biscuits, 6s. 1d.
Gikiyanakande	5 do offered and 3 sold, light roll crêpe, 5s. 6¼d.; dark 4s.
P.R. (in triangle) H.	4 packages fair to good scrap 4s. to 5s. 1d.
M.M. (in estate mark)	2 do offered and 1 sold, fine biscuits, 6s. 1d.
Rangbodde	1 case fine biscuits, 6s. 1½d.
F. J. W.	2 do fine pale pressed worms, 6s. 2¼d.
New Rasagalla	2 do offered and 1 sold, fine biscuits, 6s. 1d.
Hapugastenne	3 do fine biscuits, 6s. 1d.; fine scrap, 5s. 2½d.

STRAITS SETTLEMENTS.

M.I. (in diamond)	3 do fine biscuits, 6s. 1d.; fine scrap 5s. 3¼d.
L. E. (Muar in triangle)	10 do fine pale crêpe 6s. 1½d.; dark 5s. to 5s. 3d.

MARK.	QUANTITY, DESCRIPTION AND PRICE PER LB.
P.S.E. (in diamond)	2 cases fine sheet, 6s. 1d.
C. R. (R. W. & C in triangle)	15 do fine sheet, 6s. 1d.; good scrap 4s. 8½d. to 5s.
V.R.C. Ltd. Klang F.M.S. (in triangle)	32 do offered and 21 sold, fine sheet, 6s. 1d.
Gula (in diamond)	2 do fine sheet 6s. 1d.; fine scrap 5s. 2¼d.
S. R.C. (in triangle)	25 do offered and 10 sold, mixed crêpe, 5s. 6¾d.; poor crêpe, 4s.
P.R. S.B.	8 do fine sheet 6s. 1d.; good scrap 4s. 8d.
G.M. S.B.	6 do fine sheet 6s. 1d.; fair to fine scrap 4s. 6d. to 5s. 3d.
OBEC. (in diamond)	5 do fine sheet 6s. 1d.; good scrap, 5s.
S. (in diamond) S.R.	1 do poor scrap, 3s.

SHIPMENTS OF PLANTATION RUBBER.

FROM COLOMBO AND GALLE.

1906	... First three months	... 31 tons.
1905	... ,,	... 12¼ ,,
1904	... ,,	... 9 ,,
1903	... ,,	... 5¼ ,,

FROM SINGAPORE.

1906	... First three months	... 47 tons.

FROM PENANG.

1906	... First three months	... 9 ,,

Total Exports from Ceylon and the Straits Settlements for first three months, 1906, 87 tons.

SHIPMENTS OF PLANTATION RUBBER.

Total Exports from Colombo and Galle from 1st January to 23rd April:

1906 ...	... 35½ tons.	1904 ...	... 10¾ tons.
1904 ...	... 13¾ ,,	1903 ...	... 5½ ,,

Total Exports from Singapore from 1st January to 6th April, 1906, 48½ tons.

GOW, WILSON & STANTON, LTD.

We much regret that by an inadvertence, the rubber report given in the April number (page 204), was credited to the "India Rubber Journal." It should have been entered as due to Messrs S. Figgis & Co., who prepared it at considerable trouble.

Cultural Directions for Camphor.

INSTRUCTIONS BY A JAPANESE SUPPLY CO.

The Yokohama Nursery Co., Ltd., of Yokohama, publishes the following cultural directions for camphor:—Plants are quoted at the following rates:—Height 1—1½ ft.; per 10 $1·30 (gold); per 100 $11·50; per 1,000 $100.

SEED-BED.—Prepare in well fertilized and rich soil. Plow 18 inches deep. break the lumps finely, make dikes two feet apart for drainage and press the surface, smoothly. Mid-spring is the time of the sowing season or when the temperature ranges above 50 degrees Fahrenheit. The seeds being sown, cover them up by means of a sieve through which soil is allowed to fall to about half-an-inch and press the top lightly. Straw or hay should be spread over the bed so as to protect the seeds from being washed or blown away by storms, and also to prevent its getting too dry until they sprout, care being taken to keep the straw in place by sticks fixed into the ground.

For one pound of seeds, a space of six square yards is usually allotted, but the more sparsely sown the better for the growth. One pound produces 2,000 plants on the average, but much naturally depends upon the state of a crop.

MANURE should be given in summer and autumn. In Japan decomposed ordure mixed with oil cake is used in fluid form, but bone-dust or any similar manures will answer the purpose. No shading is required against the sun except on very hot days; water should be given in the evening. Clear off the weeds as they appear,

Transplanting.—Next spring after a year the plants should be removed. Prepare the plantation in the same manner as the seed-bed, but the stems should be cut off at one or two inches from the base and also the ends of the roots. About 20 plants are to be planted on one square yard for another year's culture. Manure in spring, summer and autumn as in the first season, tilling the ground and weeding occasionally.

Second Transplanting.—In spring of the third year the plants are ready to be removed to permanent quarters. Treat the plant in the same way as in the first transplanting by cutting off the top and roots. If they are to be planted on hills or moorlands provide a space of four square yards for a tree, otherwise 7 or 8 feet apart from each other.

The second transplanting may sound useless waste, but it is a method widely practised in a certain province. This may not be absolutely necessary to follow, and the plants can be left two or three years before being removed to the permanent quarters, but its nature is that it does not easily get acclimatized, so the double precaution may save much in the end. Camphor can be extracted from the stems as well as the leaves.

The wood of the camphor-tree is much employed in Japan for the manufacture of cabinets, chests of drawers, wardrobes, boxes, etc. Old ones have a fine close ring grain, a clear yellow-brown, silky sheen, and a beautiful appearance, so that it is well adapted for veneering. Not being subject to the attacks of insects, it is very useful for such works, besides the odour of the wood imparts a delightful fresh scent to the articles stowed in the receptacles.

Apart from its economic value the plant has an occult hygienic property. Giant camphor-trees of several centuries old are invariably to be met with in the precincts of temple and shrines of the southern section of Japan, and the people feel from traditional instinct a sacred sentiment towards the tree, but science has revealed the truth that it serves as a natural purifying agency against any pestilential atmosphere. Its evergreen nature, lustrous dense foliage, mighty form, extraordinary longivity and aromatic property are the features highly recommendable wherever climatic and topographical conditions agreeable as a garden plant, especially on large estates.

DYE STUFFS AND TANNING SUBSTANCES.

UTILISATION OF MANGROVE BARK.

The name "mangrove" was applied by Lindley to the trees belonging to the natural order Rhizophoraceæ. These trees or shrubs inhabit the muddy swamps close to the seashore in tropical climates, where they frequently form forests of vast extent. The mangroves are of particular interest, owing to their peculiar habit of growth, which is described by Hamilton as follows:—"In the economy of nature the mangrove performs a most important part, wresting annually fresh portions of land from the dominion of the sea. This is effected in a twofold manner, by the progressive advance of their roots and the aerial germination of their seeds, which do not quit their lofty cradle until they have assumed the form of actual trees, and drop into the water with their roots prepared to take possession of the mud, in advance of their parent stems. The progression by means of the roots is effected by fresh roots, which issue from the trunks at some distance above the surface of the water, and arching downwards, enter the mud. In this manner, the plants, after their descent from the parent trees, continue during their early years to advance steadily forward till they have attained a height of about fifteen feet, and gained a position considerably in advance of their parent trunks. After this fewer additions are made to the roots, but the head begins to expand in every direction, spreading its branches on all sides. These branches in turn send down long slender roots like those of the banyan tree (*Ficus indica*), which, rapidly elongating, descend from all varieties of height, and, reaching the water, penetrate the mud, becoming in time independent trees; thus a complicated labyrinth is formed."

It has long been known that all parts of the mangroves, and especially their barks, contain tannin, but it is only comparatively recently that mangrove bark has been systematically collected and imported into Europe for the use of tanners.

MANGROVE BARKS SUITABLE FOR TANNING PURPOSES.

The mangroves best known as yielding barks suitable for tanning purposes are *Rhizophora mucronata*, *Rhizophora Mangle*, *Bruguiera gymnorrhiza*, *Ceriops Candolleana* and *Roxburghiana*, and *Kandelia Rheedii.*

Mangroves yielding barks rich in tannin are fairly widely distributed in tropical countries, and in recent years a good deal of attention has been paid to the exploitation of these materials in various countries, notably Germany and Belgium. The best-known mangrove barks in European commerce are probably those of

GERMAN EAST AFRICA,

which have been made the subject of special study by Dr. Busse (Chem. Centr. 1899. I. (4), p. 315), and by Professor Körner, whose analyses are recorded in Jahresberichte Gerbschule, Freiberg, 1899-1900.

These results show that the richest mangrove barks obtainable from German East Africa are the "Mkaka," derived from *Rhizophora mucronata*, which may contain as much as 48.0 per cent. of tannin, though samples containing only 21·3 per cent. were examined. The "Msinzi" bark, derived from *Bruguiera gymnorrhiza*, contained from 44 to 53 per cent. of tannin, whilst the "Mkandaa" and "Mkamavi" barks, obtained from *Ceriops candolleana* and *Xylocarpus granatum* respectively, contained 42·3 and 40·5 per cent. of tannin. Quite recently a similar series of barks from

ZANZIBAR

was examined at the Imperial Institute, and the results, which were given fully in the Bulletin of the Imperial Institute, 1904, Vol. ii., p. 165, showed that the "Msinzi" bark of Zanzibar contained 35·8 per cent. of tannin, and the "Magomi" and "Mkomafi" barks of Pemba, 32·8 and 23·8 per cent. of tannin respectively. These East African barks seem, on the whole, to be richer than those of

INDIA AND THE EAST INDIES.

A series of mangrove barks and extracts prepared in India was examined at the Imperial Institute in 1899, and the results are given in Technical Reports and Scientific Papers, Part 1, p. 186. For the present purpose it is, perhaps, sufficient to recapitulate briefly the amounts of tannin found in the various barks —*Rhizophora mucronata*, 4 to 27·29 per cent.; *Bruguiera gymnorrhiza*, 12·77 per cent.; *Ceriops Candolleana*, 13·23 to 21·54 per cent.; *Ceriops Roxburghiana*, 23·54 per cent.; and *Kandelia Rheedii*, 11·99 per cent.

CEYLON, BORNEO AND THE STRAITS.

Some attention has also from time to time been paid to the utilisation of mangrove barks in Ceylon, Borneo and the Straits Settlements, and recently a considerable export trade in mangrove barks, and so-called "mangrove cutch," has arisen in Sarawak and British North Borneo. In the Federated Malay States considerable quantities of mangrove timber are used at present, but the bark seems generally to be thrown away, though in the Dingdings, according to the District Officer, some "Tengah bark" (*Ceriops candolleana*) and "bukan bark," derived from a *Rhizophora* or *Bruguiera*, is used locally, and exported for tanning purposes (Agricultural Bulletin, Straits Settlements, Vol. iv., pp. 3 and 124). Barks derived from a *Bruguiera* or *Rhizophora* species, and containing from 19 to 24·3 per cent. of tannin, are also used locally in Indo-China (Feuille de Renseignments, 1904, 58, p. 2). Perhaps the most recent addition to the countries exploiting the mangrove for bark is

QUEENSLAND.

A short description of the conditions under which it is collected in this Colony is given in the Bulletin of the Imperial Institute, 1904, Vol. ii., p. 276, where it is shown that the Queensland bark contains 39·5 per cent. of tannin. A region celebrated for the extent of its mangrove swamps is

WEST AFRICA,

but so far no serious attempt seems to have been made to collect this product for export in any of the West African Colonies. Possibly the reason of this is that the oil palm (*Elaeis guineensis*) is so plentiful and its products are in such demand at remunerative prices, that there is no incentive to collect less valuable products such as mangrove barks.

Some years ago this industry was started in Senegal by a French firm, but after a short time the collection of the bark was prohibited by the Government, for the reason that the mangrove trees were cut down with the result that rapid erosion of the foreshore took place. Recently, however, M. E. Baillaud has again directed attention to this subject (Journal d'Agriculture Tropicale, 1904, Vol. ii., p. 200) and has given an account of some preliminary experiments made in the collection of the bark by natives in French Guinea.

COLLECTION AND EXPORT OF MANGROVE BARK.

In German and Portuguese East Africa, where mangrove bark has, perhaps, been more systematically worked than elsewhere, the mangroves were at first

cut down for timber, and the bark was wasted until its value as a tanning agent was discovered. In the German protectorate the bark is now stripped from the stems and branches of the living trees, conveyed to convenient centres, broken up, and dried in the sun (or by artificial heat produced usually by the combustion of mangrove timber), and exported.

The industry is under the control of the Forest Department, which insists on the bark being carefully stripped, so that the trees are not destroyed (stripped trees are said to renew their bark in from four to six months), and the authorities also prohibit the export of bark containing less than 45 per cent. of tannin.

In M. Baillaud's experiments much the same plan was followed, and it was found that natives working piece-work could collect about 200 lb. of bark per day, and it was estimated that to place a ton of the bark in Europe would cost fr. 124 c. 50, which seems to be an unnecessarily high figure. It was noticed that if the bark is exposed to the rain after collection, a considerable loss of tannin occurs, so that it is desirable that the drying be conducted under cover when wet weather prevails. In the East Indies the bark is stripped, then dried, and roughly ground and packed in small bales, sometimes under pressure. In this way the cost of transport to Europe is reduced somewhat. Allusion has also been made to the fact that the authorities in German East Africa prohibit the export of bark containing less than 45 per cent of tannin, and where such regulations are not officially in force, it would be well for exporters to adhere to this rule, since tanning materials are now almost universally bought on their actual content of tannin, and mangrove bark containing less than 45 per cent. of tannin is scarcely saleable, and the inclusion of such material with good bark might lead to losses.

But little attention has as yet been paid to the utilisation of mangrove timber. M. Baillaud states that it is, as would be expected, peculiarly resistent to the action of water, and is therefore suitable for the construction of piles, railway sleepers, and similar articles where hardness and great resistence to the action of water are of importance. It has also been used for street paving in Paris, but apparently the price obtainable for it for this purpose did not prove remunerative.

MANUFACTURE OF MANGROVE EXTRACT.

In the countries where mangrove bark is principally produced at the present time, skilled labour is not usually available, and consequently the manufacture of mangrove extract from the bark is difficult if not impossible. There can be no doubt, however, that if the extract could be made in these countries much of the poorer bark at present discarded could be utilised, and as the export of extract would mean that only the really useful portion of the bark would be sent to Europe, a great saving in the cost of transport would be effected. It may be worth while, therefore, to give here a short account of the modern process of preparing tanning extracts from mangrove bark and similar products.

The bark, after being thoroughly air-dried, is ground in a bark mill or disintegrator so as to form a powder, through which water will percolate slowly. This is then packed into "leaches" or extractors, which usually consist of round pine-wood tubs, strengthened by iron hoops and provided with perforated false bottoms, below which the extracting liquor may collect. A series of these "leaches" is employed, a connection by means of a copper or leaden pipe running from the chamber below the false bottom of each to the mouth of the next. Each is also provided with a pipe, whereby steam can be introduced, so that the extracting liquid may be heated to any desired temperature. Water is allowed to flow into the first extractor of the series, which is then heated by means of its steam jet. The warm water percolating downwards through the ground bark, extracts the tannin and other soluble matters, and the liquor so produced gradually

accumulates below the false bottom, and as this fills the liquor is forced by the pressure of the water, which is continually supplied to the first extractor, over into the second extractor, and so on throughout the series, until from the last a comparatively strong liquid is obtained. This is then run into a vacuum-evaporator of the Yarian or similar type, in which it is exposed in thin layers for a short time to a temperature of about 80° C., whereby it is converted into a thick liquid of specific gravity 1·2. Thence it is run into an ordinary vacuum-pan, and evaporated in vacuo to a satisfactory consistence. The process thus briefly outlined yields a satisfactory extract (cutch) for dyeing purposes, but one of the greatest objections to the use of mangrove bark or extract for tanning purposes is, that it produces a leather having an objectionable red colour, and consequently it is necessary in manufacturing extracts for tanning purposes to decolorise the liquor at one stage in the process. This is necessary not only because of the colouring matter naturally present, but also because in the process of manufacture the application of heat to the tannin and extractive matters leads to the production of dark-coloured substances by their partial decomposition. The decolorising process is usually carried out with the liquor as it comes from the extractors, and consists in the addition of small quantities of albumen, alum (or aluminium sulphate) or similar material, which forms an insoluble compound with a small portion of the tannin, and as this settles out it carries with it a great part of the objectionable colouring matters. Bleaching agents such as sulphur dioxide or salts yielding this have also been used for the decolorisation of mangrove and other extracts to be employed for tanning purposes, but none of these methods have so far succeeded in completely and permanently eliminating the red colour. This is the most serious difficulty in the way of an extension of the use of mangrove bark as a tanning agent, and recently the German Colonial Society has offered a prize of 3,000 marks for a satisfactory and permanent method of decolorisation. The conditions under which this prize is offered are given in Der Tropenpflanzer, 1905, pp. 475—6.

The total cost of a small plant arranged on modern lines for the manufacture of mangrove extract, and with a sufficiently large capacity to be remunerative in working, would probably be from £450 to £500.

QUALITY OF LEATHER PRODUCED BY MANGROVE BARK.

Reference has already been made to the dark-red colour of the leather tanned by mangrove bark or extract, and the fact that this colour depreciates its value. Apart from this defect, mangrove-tanned leather when properly made seems to be of fair quality and suitable for shoe leather and similar purposes. On this point Professor Proctor, of the Leather Industries Laboratories of the Leeds University, says that "mangrove bark is now largely used in conjunction with pine, oak and mimosa barks, and that extract prepared from *Ceriops Candolleana* makes a good but dark-red leather"; and Professor Korner, of the Freiberg Tannin School, as the result of his experiments on the value of mangrove extract as a tanning agent, states that "it yields a soft and pliant, workable leather, which, however, possesses an objectionable red colour, which can only be modified sufficiently for commercial purposes by using it in conjunction with myrobalans, valonia, sumach or similar light-coloured tanning materials."

EXTENT OF TRADE IN MANGROVE BARK.

It is impossible to give any exact figures showing the total amounts of mangrove bark and extracts imported into the principal European countries, since these are not separately shown in the returns, but the following statements and statistics seem to show that the demand for mangrove bark and cutch in Europe has in recent years reached a considerable total.

H. M. Consul at Mozambique, in a dispatch in 1904 to the Foreign Office, states that the quantities of mangrove bark exported from the principal ports of Portuguese East Africa during 1904 amounted to 12,105 tons. These exports seem to have been sent principally to Germany, the United States and Russia, small quantities only being sent to the United Kingdom. In addition to these large exports it is further stated that a large amount of mangrove bark was, at the end of 1904, lying in the various ports awaiting collection, and it was understood that two sailing vessels were being chartered to convey it to Europe owing to the uncertainty of steamship facilities for the transport of the bark. The value of the bark in European markets at the end of 1904 is stated by the Consul to have been from £4 10*s* to £6 10*s*. per ton, and he goes on to say that while the demand in Germany was slack, that in the United States and Russia was firm. The cost of collecting, drying and packing the bark in Portuguese East Africa is estimated at from 20*s*. to 30*s*. per ton, including the export duty of 2*s*. per ton. The freight to Hamburg at that time was about 32*s*. per ton.

The Diplomatic and Consular Report on the British East Africa Protectorate for 1902 No. 2903, p. 13 gives the following statistics of the exports of mangrove bark, known locally as "boriti bark," from that country:—

		Value.
1900-1	... ...	£998 14s. 8d.
1901-2	... ...	£908 14s. 8d.

The export duty on the bark from British East Africa was then 10 per cent. *ad-valorem*.

The Diplomatic and Consular Reports for Sarawak, Brunei and British North Borneo, for the period 1898—1903, give the following figures for the exports of mangrove cutch made there. These exports went principally to the United Kingdom:—

EXPORTS FROM SARAWAK.

		Piculs.	Value.
1899	... ...	1,612·5	£1,197
1900	... ...	1,260·0	£1,039
1902	.. ..	3,488·75	——

EXPORTS FROM BRITISH NORTH BORNEO.

		cwt.	
1903	... ...	18,000	(estimated)

These figures may be supplemented to some extent by the import returns for cutch in the United Kingdom, which show that in 1903, 269 tons of cutch, valued at £7,149, and 1904, 254 tons, valued at £5,299, were imported into the United Kingdom from British North Borneo. It may be assumed that this was entirely mangrove cutch. Mangrove cutch, as already explained, is principally used by dyers, and it seems to have taken the place to some extent of the true cutch largely produced in North-West India and in Burma, from the wood of *Acacia catechu*.—*Bulletin of the Imperial Institute*, Vol. III, No. 4, 1906.

FIBRES.

COTTON-GROWING.

When the highly remunerative result of the cotton crop of 1905 is considered, it seems extraordinary that cotton-growing should this year once more have to be reckoned amongst the neglected industries. If all the men on the land were dairy farmers, we could easily understand that fodder crops would claim all the available arable land. Those who are now devoting their energies to raising lambs for export would also not be likely to touch cotton. But there are hundreds of farmers who devote their land to the ordinary farm crops, some of which, according to meteorologists, will continue for a cycle of years to scarcely pay for the labour of cultivation, preparation, and marketing. To such men the business of cotton-growing should appeal with much more force. They appear to fear that the price of cotton will fall to a non-paying point about the time when their crop would be ready for market. But what are the facts? What prospect is there of a fall? The cotton-growers of the United States have again had a short crop. The estimated 12,000,000 bales for 1905-6 will not be realised by at least 3,000,000 bales, and of a 9,000,000 bale crop an immense proportion is used in the American cotton mills, which are yearly increasing in numbers. England must have cotton, so must Germany and France. If America cannot supply it, it must be got elsewhere. But from what country? From India? From Africa? From the West Indies? From Egypt?

Let us take India. Large quantities of cotton are produced there certainly, but, although thousands of pounds sterling have been expended in attempts to produce a cotton such as any Queensland farmer can produce, failure has constantly been recorded, and lately India has had recourse to Queensland to obtain seed of a variety which in this State succeeds well in the North, whilst in all probability it will share the fate of all other imported varieties in India. We allude to the two Caravonica varieties grown by Dr. Thomatis, at Cairns. That gentleman has lately sent large quantities of seed to India—we cannot say at what price, but rumour has it the doctor's cotton seed is proving a mine of wealth to him. As a rule, Indian cotton is short in staple and rather coarse, and consequently does not fetch a high price in the English market. The annual output of Indian cotton is about 3,000,000 bales of 500 lb. each. As to Africa, good cotton can be grown there, but, in spite of the supposed cheapness of native labour, late accounts state that owing to labour troubles cotton-growing in some parts has had to be abandoned. In the West Indies practically only one kind of cotton is grown—Sea Island, which always brings a high price. But the range of Sea Island cotton is limited, and the demand for it can scarcely be supplied by the West Indies and the American Sea Islands together. The total world's production of Sea Island cotton is only 110,000 bales, of a value of £100,000. In Queensland, Sea Island cotton can only be grown successfully on the coast, particularly in the Northern districts. Inland from Brisbane, Maryborough, Rockhampton, and Townsville westwards, the Upland cotton must be grown. Egyptian cotton has always been famous for its excellence, both of colour, length of staple, and fineness; but of late the value of Egyptian cotton has much deteriorated owing to carelessness on the part of the growers about the seed. Different varieties have been grown in the same field, with the result that produce is mixed and therefore not so valuable as it used to be. Egypt

exports about 290,000 tons of cotton annually and 17,000,000 bushels of cotton seed. Exclusive of these—America, Egypt, and India—the rest of the world produces about 1,000,000 bales of 500 lb. each. The present annual production of cotton all over the world is about 16,000,000 bales, whilst the present demand far exceeds this, and in two or three years it is estimated that the demand will reach 19,000,000 bales.

All this goes to show that there is no present prospect of a low price for the raw material, and that an excellent market is awaiting all the cotton that can be grown in Queensland. To produce an acre of cotton entails far less labour than to produce an acre of maize. The value of the produce of an acre of maize is about £6, from which has to be deducted the cost of cultivation, husking, threshing, and bags. An acre of well-grown Uplands cotton is worth at 1½d. (£6 10s.) to 2d. (£8. 16s. 8d.) per lb., from which has to be deducted the cost of cultivation and picking. An acre of Sea Island cotton is worth double this. If farmers would ponder this matter and plant a few acres of cotton every year, it would not be long before a large export trade would arise, and like sugar, cotton would become one of the chief staple products of the State.—*Queensland Agricultural Journal*, April, 1906.

MADAR: A FIBRE PLANT.

(CALOTROPIS GIGANTEA, R. BR.)

Calotropis gigantea and *C. procera* are easily distinguished, though from a practical point of view, their properties are identical. Both flowered under cultivation simultaneously at Kew, and are figured in the Botanical Magazine for 1886 (tt. 6862 and 6859).

C. gigantea is a much larger, coarser plant than *C. procera*. Both are widely spread in India. But outside it their distribution, as Sir Joseph Hooker points out, is contrasted. *C. gigantea* reaches eastwards to China, while *C. procera* extends westwards and reaches the Cape de Verd Islands. The present notice deals with the former species, though most of what is to be stated would apply equally to the latter,

It is an erect spreading perennial bush which chiefly frequents waste lands in the warm moist tracts of most tropical countries, in India being especially abundant in Bengal, Assam, South India, and distributed to Ceylon, Singapore, the Malay Peninsula, and China. Both the species are known by the following names:—Madár (sometimes written by Europeans as mudar or even muder), ák, ákanda, árka, yercum, &c.

One of the earliest European writers to describe this plant was Prosper Alpinus (De Plant. Aegypti, 1592, Ch. XXV.). He tells us that it is the 'beidelsar' of Alexandria, where it grows in damp places. Rheede was the earliest Indian botanist to narrate its properties (Hort. Mal. 1679, II., t. 31), and he furnished a most accurate drawing of the plant. He calls it ericu. Rumphius (Hort. Amb. 1755, VII., t. 14, f. 1) gives a poor illustration, but describes the plant in great detail under the name of mador. Sir W. Jones (As. Res. IV. 1798, p. 267) describes it under the name arca. Roxburgh placed it in the genus *Asclepias*, and Robert Brown, a little later, assigned to it a separate position under *Calotropis*. It is a sacred plant with certain Hindus, and is associated with the observances of the maruts or winds, the demigods of Rudra. The ancient Arabs also appear to have had superstitious beliefs regarding it, since they associated it with sun-worship. It is the ushar of the Arabs and the khark of the Persians, but the former seems to be a generic word for milk-yielding plants, and was probably restricted to *Calotropis* at a comparatively late date. Abu Hanifeh was perhaps the first Arab writer to give an explicit account of it, but much useful information will be found in the writtings of Ebn Baithar (Transl. by Southeimer, II. 193).

This plant may be said to yield Gutta-Percha from the milky sap; a strong fibre from the bark; a useful floss from the seeds; and a medicine from the root-bark. Space cannot, however, be afforded to do more than review even these properties very briefly, and there are many minor ones.

The Gutta-Percha.

The inspissated and sun-dried sap (milk) drawn from the stems constitutes the madar gutta often mentioned by writers on India. It is, in fact, the most hopeful of the many gutta-yielding plants that do not belong to Sapotaceæ, the family which affords the true gutta-percha of commerce. There are large tracts of the sandy deserts of Rajputana and Central India, as also of Sind in which this plant is not only the most prevalent but almost the only form of vegetation met with. In many instances also it has been observed to be the pioneer in the reclamation of sterile tracts. If, therefore, a demand could be originated for any one or all collectively of the products of this plant, much good might result to India. Its production could be fostered, and by selection and cultivation the quality and quantity of the produce improved, until the plant assumed the condition of a regular crop for poor soils. But unless some method could be designed for extracting the milk from shoots cut on account of their fibre, it is feared that it would not pay to tap this plant specially for its gutta. The stems and twigs are too small, and the yield from each too little, to justify the opinion that methodic tapping would prove remunerative as an industry by itself. Moreover, it has been found by chemical experiments that Calotropis gutta, being a fairly good conductor of electricity, it is not suited for electric purposes, and is thus very possibly debarred from one of the most profitable markets for this class of product.

Bark Fibre.

The bark fibre has attracted considerable attention and been spoken of as one of the best of Indian fibres. The great difficulty appears to consist in the inability to separate it rapidly and cheaply. Unfortunately the fibre cannot be prepared by retting the stems, since it is reported to rot when so treated, and yet the clean fibre when made into fishing lines and nets (as is the case in Karachi) seems quite durable and very strong, especially when used in sea-water. Mr. Liotard, after many experiments performed in Calcutta with fibre-extracting machinery generally, arrived at the unfortunate conclusion that the hopes formerly entertained by himself and others regarding this particular fibre were never likely to be realised:—1st, because of the small percentage of fibre (1·56) to weight of stems, and 2nd, the shortness of the ultimate fibre. But in recent experiments conducted at the Imperial Institute with a sample procured from Madras, Professor Wyndham R. Dunstan found that the staple measured fully 12 inches (Agr. Ledger No. 2 of 1899, p. 3). Charles Richards Dodge (Useful Fibre Plants of the World, 104) says that an acre of ground planted 4 by 4 feet with this plant will yield ten tons of green stems and 582 lbs. of fibre; this would mean a yield of roughly 2·6 per cent. He then adds that the fibre possesses many of the qualities of flax, though somewhat finer. Its fineness, tenacity, lustre, and softness in fact fit it for many industrial purposes. Cross and Bevan found that when nitrated it could hardly be distinguished from silk, and long years ago Wight showed that a rope of this fibre broke with a weight of 407 lbs., when a similar rope of cotton gave way with 346 lbs., and coir with 224 lbs. It is, however, quite incorrect to affirm as has been done by Wiesner (Rohst. d. Pflanz. Rch. II. 317), Dodge, and others, that this fibre is widely used in India. Although prepared to a small extent by certain persons for very special purposes, the greatest possible difficulty was experienced in procuring the few pounds required by the Imperial Institute for the experiment just mentioned.

Mr. G. W. Strettell (New Source of Revenue to India) advocates the value of this plant as a paper material. It may thus be fittingly concluded that, were it found possible to utilize the gutta as an additional source of revenue, the fibre, either for textile purposes or paper-making, might, in spite of all that has been said to the contrary, prove worthy of special consideration.—(The Agri. Ledger, No. 2 of 1899.)

FLOSS.

The coma of hairs or floss from the seeds constitutes one of the so-called vegetable silks or silk-cottons. This was chemically examined by Mr. Cross (see The Agricultural Ledger, No. 17 of 1897, p. 3) and found to possess an abnormally high percentage of furfurol. It was further believed to give evidence of being unsuited for some of the purposes of the textile industries. In practical experiments it has been found that the staple was too short and too light for existing machinery, the latter property allowing the fibre to be blown away. It is, however, a soft, very white floss, with a beautiful silky gloss, has been repeatedly spun experimentally in Europe, and the textile produced much admired. Reporting on a sample of the floss submitted to him by the Imperial Institute, in 1897, Mr. C. E. Collyer observed that some years previously the floss had been in demand for fancy textile purposes, but that it had dropped out of use owing to the difficulties arising from variation in the quality of the parcels sent and the intermittency of the supply when requirements arose. He thought that the trade might be revived if a moderate but continuous supply could be guaranteed. Good quality floss might realise 4*d.* to 5*d.* per lb. The pods and seeds should be removed but the floss left in its natural condition, unopened and discoloured portions removed. Notwithstanding all this, no progress has been made in the utilization of the fibre. In India it is largely employed for stuffing quilts, its lightness being of great advantage, and in upholstery it holds a recognised position, since pillows and cushions stuffed with it are held to be very cool and refreshing. It is also, to some extent, regularly spun and made into fishing lines and nets.

Such then is all that can be said of the utilization of this floss at the present day. But there would appear to be little doubt that a few centuries ago this fibre was regularly spun and woven into some of the most beautiful textiles for which India was then famed. Human labour was of much less value than at the present time. Modern advances, coupled with the import of cheap European goods, seem to have destroyed the old industry. It would appear fairly certain that the madar floss was the "grass," the "cloth of herbes," "herba," &c., of early European travellers and traders in Bengal, more especially Orissa. Further, that the traffic they allude to gave to the English language the expression "Grass-cloth," which later on became associated with a textile derived from China. Thus Caesar Frederike (1563-7) speaks of "Cloth of herbes,"—"a kind of silke which groweth amongst the woodes without any labour of man. And when the bole thereof is growen round as bigge as an orenge then they take care onely to gather them." Rhea never could have been found as a wild plant in Orissa, and the allusion to the "bole" or fruit, from which the fibre was obtained, precludes rhea from consideration altogether. The passage most unquestionably denotes *Calotropis gigantea.* This view is confirmed by Fitch (1585) who gave an account of his exploration of the Ganges, including Orissa (Orixa as he calls it) where there was "great store of the cloth which is made from the Grasse which they call yerua." That vernacular name is clearly a form of the word that denotes *Calotropis* throughout Orissa and the Canartic to this day. Doubtless, also, Linschoten's "Herbe Bengalen" was the same textile. I have purposely made reference to Linschoten, under *Boehmeria nivea,* because all modern writers, whom I have been able to consult, quote the above passages, and several others to the same effect under Rhea, in place of *Calotropis,* to which they most undoubtedly belong. Coming to more recent dates,

Capt. A. Hamilton (New Account of E. Indies, pub. 1744) who in 1627, visited Bengal, and passed up the Ganges to Benares and Patna, describes Balasore as producing manufactures of cotton, silk, mixed silk and cotton, and of "herba (a sort of tough grass) of which they make gighams, pinaseos, and several other goods for exportation." Even so late as 1813 Milburn mentions, among his Bengal piece goods, "herba taffaties."

Though it is certainly most surprising that this ancient industry in silk-cotton textiles should have died out completely, and been all but forgotten, it is a useful object lesson of the possibilities of the future, which manufacturers would do well to consider.

MEDICINE.

It would take many pages to indicate even a tithe of the information that exists on the varied medicinal properties of the milk, the flowers, the leaves, and the root-bark. The late Dr. Kanny Lall Dey, C.I.E., regarded madar as a useful medicine when given during remission of intermittent fevers, and especially if these were associated with eczema. The majority of Indian medical writers extol the merits of the root-bark in the treatment of dysentry. In order to verify these opinions, the study of madar was taken up by the Central Indigenous Drugs Committee of India. Authentic parcels of the root-bark were procured and made up in the form of both a powder and liquid extract. These preparations were issued to a selected number of Hospitals and Dispensaries throughout India, with the suggestion that they should be used as alteratives and alterative tonics. By chemical tests it had been previously ascertained that the bark of mature plants was preferable to that of immature ones, since they contained a higher percentage of the acid and bitter resinous matter on which the property depended. As a substitute for ipecacuanha it is not so satisfactory as its reputation would seem to imply. In fact, in acute dysentery and chronic diarrhoea, it is found undesirable, and certainly less efficacious than ipecacuanha. When given in large doses it frequently occasioned nausea and vomiting, so persistent and severe as to make the drug objectionable if not dangerous. In small doses of, say, 3 to 5 grains of the powder (preferably), its action on the stomach was that of a mild stimulant, hence the opinion was often expressed that it might, with advantage be combined with cinchona in the treatment of certain fevers. As an emetic the powder, in doses of 30 to 40 grains, was found very effectual.—*George Watt in the Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information Nos. 157–168, 1900.*

DRUGS AND MEDICINAL PLANTS.

CINCHONA BARKS AND THEIR CULTIVATION.*

I propose to give a brief sketch of some of the results of the cultivation of cinchona bark, and before doing so, will only venture on a mere reference to the previous history of the cinchona barks and to the chemistry of their alkaloids; for the former I would refer anyone interested in the subject to the admirable work by Sir Clements Markham, entitled "Peruvian Bark," and for the latter to Leger's admirable monograph, "Les alcaloids des Quinquinas."

Quinine and its cognate alkaloids have hitherto only been found in the barks of the genus cinchona and the allied genus remgia. These are only found in a limited zone of the eastern slopes of the Andes, and nothing was known to Europeans of their medicinal properties till some time after the Spanish conquest. It is not certain whether the Indians were aware of them, but if they were, they concealed their knowledge from their conquerors. In 1638, the wife of the governor, the Count of Chinchon, being very ill with malarial fever was cured by the administration of a hitherto unknown remedy, and she took great pains to introduce its use in Europe, and hence the name of the genus which purists spell Chinchona.

The chemistry of these barks was investigated by Dr. Gomes, a Portuguese, who isolated cinchonine in 1816, and in 1820 Pelletier and Caventou isolated quinine, and the alkaloid has since then taken the place of the bulky powdered bark that was formerly employed in medicine. The later investigations into the properties and relations of the various cinchona alkaloids opens up so wide a subject that I will not attempt to go into it, especially as I have very little that is unpublished to add to the stock of knowledge.

From that time the use of cinchona bark and quinine in medicine steadily increased, and as the collection of the bark was in the hands of ignorant Indians who never thought of planting trees to replace those cut down, district after district was denuded of the trees, and there was every prospect of most inefficient supplies if not of extinction of the genus.

In British India there was not only a great demand for quinine, but climatic conditions very similar to those on the Andes, and the government wisely determined to set about the introduction of the cinchona into the country. It was no easy matter, the bark collectors arguing rightly enough that if the bark was cultivated elsewhere their occupation would be gone, and any one who was even suspected of an attempt to carry off plants or seeds went in peril of his life. Undeterred by these difficulties, Sir Clements Markham and his coadjutors arranged expeditions into the districts from which the most valuable species were procured, and after adventures, far more interesting than those of a novel, succeeded in bringing home plants in Wardian cans and seeds of various species, specially of the succirubra and officinalis.

It all sounds very easy, but to get the plants alive to the coast, to keep them alive on the voyage to England, and again through the Red Sea was a triumph of skill and patience. When they reached India, they were cultivated with infinite care and skill at Darjiling and on the Himalayas. At the former place the government were fortunate in securing the services of a Scotchman named MacIvor, who nursed them as only a Scotch gardener can. The cultivation prospered and spread to other districts of India and Ceylon, and for 10 or 15 years the greater part of the quinine supply of the world was obtained from India and Ceylon.

* A paper read at a recent meeting of the London Section of the Society of Chemical Industry, by David Howard.

The cultivation of these barks under such skillful management has thrown light on many questions as to the formation of alkaloids in these barks. Samples of wood and leaves of the trees were carefully examined for the alkaloid, but none was found in either; it seems, therefore, that the elaboration of the alkaloids takes place solely in the downward course of the sap. Further, that the percentage of alkaloid constantly increases in the bark from the twigs to the ground, and certainly in the less flourishing tree the root bark is richer still. Another curious point is shown by such analyses, namely, that the root alkaloid invariably contains more of the dextogyrate alkaloids, quinidin and cinchonine, than the bark of the same tree above the ground.

Another point of great interest that has been made very clear is, that the more flourshing a tree is the more alkaloid it will produce, and the result of cultivation has been to produce bark yielding 10 per cent. or even more of alkaloid; this is three or four times as much as was found in the average wild barks of commerce. I remember that the first 5 per cent. bark I tested, astonished me so much that I at once repeated the analysis, thinking that my weighings must have been wrong. To obtain such results as these, however, it is necessary to have the best varieties as well as healthy trees. The yield from trees growing side by side, all from the same cultivation, of the same seed, in the same soil differs very widely, and a great number of analyses of individual trees showed by the irregular incidence of good and bad tests that the variation must be in the trees and not in the conditions of growth.

* * * By the application of various manures to these trees, it was shown that such manures as increased the apparent vigour of the trees increased their alkaloid yield, and that for this purpose nitrogenous manures were the best.

I may mention that for the purpose of these analyses, the trees were not cut down, but strips taken from them at the same height above the ground.

As the wood of the trees is of little or no use, a system of bark collection was adopted in India and Ceylon, similar to that by which cork is obtained. In this country, if a portion of the bark is taken from a tree, nature makes an attempt to heal over the wound, but the process is capricious and often fails, but in hot climates it takes place much more freely, provided always that the cambium is not damaged. Of course, the partial removal of the bark must be longitudinal, ringing a tree will kill it even in the tropics.

The plan successfully introduced by MacIvor was as follows:—Incisions were made down the trees about an inch apart and of any convenient length, the enclosed strip being carefully cut across at the top and bottom, the strip was pulled off and dried, a strip of bark was then left untouched, and then another strip taken and so on all around the tree, which was then wrapped round with moss to keep off the sun and air, and in an amazingly short space of time the cambium poured out sap which formed bark all over the wound, not only at the side as we so often see in this country. The next year the strips left on the tree, or a portion of them, could be similarly treated, and the second or third year the renewed bark could be taken off and the same process of healing would take place. A similar process has also been treated by cutting shavings off the trees with a spokeshave, but though involving much less labor, it is less effectual, as it is most difficult to cut deeply enough into the bark to ensure the process of renewal without damaging the cambium.

The renewed bark gives very interesting results, it is in the first place richer in alkaloid; this is not surprising, as it has always been found that the alkaloids were chiefly contained in the cellular tissue of the bark, not in the fibrous

portion. In some barks these two structures are very distinct, and there is no difficulty in cutting them apart. The renewed bark shows little or no sign of fibrous growth, and is almost entirely cellular.

But not only is the quantity of alkaloid greater, but the quality is very different. The species which lend themselves best to this treatment are the succirubra and officinalis; both these and especially the succirubra yield, from the natural bark, large percentages of cinchonidine. In the renewed bark the proportion of cinchonidine is very much diminished as compared with the quinine, sometimes almost disappearing. This result is curiously different from the changes in the relative proportion of alkaloid found in the root; there the dextrogyrate alkaloids increase as against the lævogyrate, here the less oxydized lævogyrate alkaloid increases as against the more oxydized. It is difficult to imagine that one changes into the other, if Pasteur's formula were correct, and the difference were only in the oxygen, that might be, but it is evident that the difference is much more fundamental.

Another point of interest was the study of hybrids. The inflorescence of the cinchonas lends itself greatly to hybridization owing to the fact that the flowers, though having both stamina and petals are of two forms, sometimes the one, sometimes the other of the organs being prominent, and thus fertilization must take place from another flower by the help of insects.

Many hybrids were produced, but it is unfortunate that no accurate records are available of the exact circumstances of the crossing. It was difficult if not impossible to learn which species was the seed bearer. One hybrid, known as "robusta," was specially interesting, its growth was even more luxuriant than that of the parent succirubra, while the yield and purity of the quinine approximated to fine calisaya.

A great deal more would doubtless have been learned but for the fact, disastrous for British India and Ceylon, that the cultivation of cinchona in these regions ceased to be profitable. In old days the unit price, *i.e.*, the cost of each percentage of quinine in a pound of bark varied from 8d. to 2s. At 6d. the cultivation in the British plantations was splendidly profitable, but the Indian Government was not the only one that perceived this importance of cinchona cultivation.

The Dutch had, early on, rightly guessed that Java afforded an ideal home for the cultivation of cinchona, and great efforts were made to obtain plants or seed. At first, though the plants were obtained they were, either by accident or on purpose, a collection of species very interesting no doubt to the quinologist, but utterly valueless as a source of valuable alkaloid.

At last, an English merchant named Ledger, living on the West Coast of America, obtained, by the help of an Indian named Manuel, a packet of seeds, largely from one magnificent tree; when Manuel went home again the Cascerilleros found out what he had done and murdered him.

These seeds were sold by Ledger, half to British India and half to the Dutch Government; he received, I think, £50 from each, all of which he gave to the widow of poor Manuel. The British half was somehow or other mismanaged, and at any rate no success was obtained in the cultivation. The Java portion gave very different results.

In the skilful hands of the managers of the government gardens the plants throve wonderfully, and were managed with most admirable skill. The barks of individual trees were analyzed, and only those which gave high tests were allowed to flower; the seed from these were cultivated in spots far away from

other plantations, and the same weeding out of the inferior plants repeated. The result has been wonderful. The richest bark from South America, such as no doubt Ledger's seed came from, yielded up to 4 per cent. of quinine alkaloid; we now find in the Amsterdam sales, whole parcels of bark giving 10 per cent. of quinine alkaloid. Where the plant finds room for it, it is hard to guess. It is a curious question—what use if any, the alkaloid is to the life of the tree. The alkaloid is only produced in favourable soil and environments, and at high elevations. The trees may apparently flourish at low elevations or in hot houses, but in those circumstances the yield of alkaloid is very small. It is clear that the fault is in the circumstances not in the trees, for some of the richest officinalis bark in the Nilgiris was obtained from trees which were the offsprings of trees grown from the cuttings sent out by my uncle, J. E. Howard, F.R.S., from plants grown in England. These mother plants out-grew his hot houses, and had to be cut down; their bark contained but little quinine.

The wonderful strain of calisaya, called after Ledger ledgeriana, was eagerly cultivated with all the Dutch skill in gardening, and now the yield of ledgeriana bark from Java is about 12,000,000 pounds per annum. I hear of dividends of 60 per cent. from plantations in Java, and Ledger got nothing!

In the rich deep soil of Java the trees flourish marvellously and sprout so freely from the root that coppicing, instead of the laborious process of renewing, is universally adopted. In six years the plantation begins to yield, and may go on for many years.

Now, as it is cheaper to grow 6 to 10 per cent. bark in Java than 2 to 5 per cent. bark in British India, it is not wonderful that the English planters were beaten out of the field, and the Dutch planters, by growing more than the market could possibly stand, and recklessly competing in their efforts to sell, got the price down to 0·4 of a penny per unit. They were profoundly convinced of the wickedness of the quinine manufacturers of the world, but learned their lesson, and by allowing the demand to overtake the supplies, got the unit up to 2d. Over production again followed, and the price is down to 1d. and falling still.

A good deal of "hybrid" bark is sent from Java without very clear intimation of its origin, it gives a sporting interest to the analysis, as one never knows if it will turn out as calisaya or succirubra, and bark is also sent as succirubra which from its test must be robusta. Another very interesting study is given us by the grafted bark of which a good deal has been grown, ledgeriana being grafted on a succirubra stock; this "enten baast" generally gives excellent tests, but lately some of the plantations seem to have worn out and the root bark has been sent over; it is most interesting to find that this gives exactly the test of succirubra root, and "enten wortel" and "enten baast" are as different as the bark of the stock and the bark of the graft originally were. This shows that there is no transference of the alkaloid from the above downwards; that the descending sap cannot carry the alkaloid as such, but that the stem and the root each elaborate after their own kind.

The success of the Dutch in knocking out all their rivals, and it must have required the doggedness of a Hollander to hold on, even in Java at $2\frac{1}{4}$ cents, has prevented other plantations of cultivated bark having the success they deserve.

We receive, however, cultivated calisaya from the Andes, and some wonderful cultivated "soft Colombian bark" has lately been brought to London. The cultivation in Jamaica is only a question of price, and we get the very richest succirubra bark from West Africa, but as people do not take quinine for enjoyment because it is cheap, but only when they want it, the supply now seems to

have but little to do with the demand. * * * It is true that the reduction in price from 10s to 10d. has increased the consumption to ten times what it was 40 years ago, but now it is difficult to imagine that anyone now goes without quinine on account of its price.

The synthesis of quinine has always been hitherto an unattainable aim. It has been frequently attempted, and I believe that to one such attempt we owe the invention of aniline dyes; even the change from one alkaloid to another has only been effected in one case. It used to have a pecuniary as well as scientific attraction, but, from the commercial standpoint, can we hope to beat nature with her synthesis of 10 per cent. ledgeriana?

CULTIVATION OF DRUGS IN GERMAN EAST AFRICA.

A recent issue of the "Berichte über Land und Forstwirtschaft in Deutsch Ost Africa" contains an interesting account of the work done during the year 1905 at the Biological-Agricultural Institute founded some years ago at Amani in this German colony. Perhaps the most interesting development of the Institute during the year was the inauguration of the new chemical laboratory in which the various natural products of the Colony are to be systematically investigated. Among the plants now being grown in the experimental plantations are *Cola vera*, *Areca Catechu*, *Ilex paraguayensis*, *Cinchona robusta*; *C. succirubra* and *C. Ledgeriana*, *Erythroxylon Coca*, *Strophanthus gratus*, and the Javanese febrifuges *Ficus ribes* and *Jasminum glabriusculum*, all of which are stated to be doing well. The cinchonas have indeed been planted in considerable quantities, and an attempt is to be made at commercial production, though the climate of the country is said to be rather unsuitable for successful bark-growing. Black pepper, camphor, sandalwood, and *Andropogon Schœnanthus* and *A. squarrosus* are also being tried.

The first experiments with sandalwood have been failures, but further attempts to grow it are being made. Balsams are also being grown, but the dryness of the climate does not suit either the tolu or Peruvian balsam plants, though one of the storax-yielding trees—*Liquidambar styraciflua*—is said to be doing well. Fifty-eight different species of *Eucalyptus* have been planted, and 1,000 plants have been raised so far.

Attention is also being directed to the cultivation of casuarinas. Both these classes of plants are of great importance as wind-breakers and as sources of cheap fuel. The energies of the Institute chemist (Dr. Schellmann) seem to have been devoted principally to the study of manures for coffee and cotton, though he has also investigated, among other subjects, methods of preparing alcohol from sweet potatoes, the preparation of cardamoms for the market, and the tanning values of the barks of various species of *Acacia*.

A still for the preparation of essential oils has recently been fitted up, and about a kilo. of oil has been distilled from *Andropogon citratus* and samples distributed to merchants in Germany for valuation. This, however, proved not to be of very good quality. Essential oils from *Piper Volkensii* and wild cardamoms (*Amomum mala*) have also been prepared.

The most interesting mineral examined during the year was a uranium ore containing no less than 89 per cent. of uranous-uranic oxide, which proved to be highly radio-active. As its name implies, the Institute devotes special attention to applied entomology, and thirty pages of the Report are devoted to the results of the examination of the various insect-pests of economic plants and the disease-carrying insects, such as the various species of *Glossinia*, which have been dealt with during the year. At the close of the Report an interesting account is given of the bee and silkworm culture experiments, which appear to be making satisfactory progress.—*Chemist and Druggist.*

EDIBLE PRODUCTS.

The Cultivation and Curing of Tobacco.

PREFACE.

One of the most promising of the new industries of Jamaica is the cultivation of tobacco. Jamaica cigars and cigarettes have now become so widely known that the industry deserves to be taken up on thoroughly enterprising lines, for the cultivation of tobacco in Jamaica appears to be likely to repay the judicious outlay of capital in suitable localities.

Jamaica tobacco and cigars were well represented at the recent Colonial and Indian Exhibition at the Crystal Palace and secured four awards, including a 'Grand Prize.' Trinidad also secured an award for manufactured tobacco and cigarettes. Experiments in tobacco growing have been conducted at the Botanic Station at St. Kitt's since 1901, and some measure of success has been attained.

With the view of generally encouraging the cultivation of tobacco in the West Indies, the present pamphlet has been prepared. It is mainly based on information reprinted from the Bulletin of the Department of Agriculture, Jamaica.

The notes on the cultivation and curing of tobacco were written by Mr. T. J. Harris, formerly Assistant Superintendent of Hope Gardens and now Superintendent of the Botanic Station at Bermuda. Mr. Harris was for some years in charge of the experiments in tobacco production at the Hope Experiment Station, and his notes, based on this experience, are likely to be useful to planters who may desire to take up the cultivation. They form a simple and reliable guide to the various details of cultivation of the tobacco plant and the curing of the leaves for the market.

For some time an interesting experiment has been carried out at the Hope Experiment Station in connection with the cultivation of Sumatra tobacco for cigar wrappers under shade. This experiment has so far been successful, and it may lead to this class of tobacco cultivation being taken up on a fairly large scale.

The notes on growing tobacco under shade in Jamaica were written by Mr. W. N. Cunningham, who succeeded Mr. Harris as Assistant Superintendent of the Hope Experiment Station. The notes are supplemented by information on similar work in the United States, Cuba, and Sumatra.

The cost of producing Sumatra leaf in Jamaica has been placed at 2s. to 2s. 2½d. per lb. Samples of this leaf were estimated by an expert to be worth 6s. per lb. These figures are, however, liable to revision with wider experience in Jamaica and elsewhere.

The experiment has demonstrated that cigar wrapper tobacco equal, if not superior, to Sumatra can be grown in Jamaica, and that its cultivation would probably leave a good margin for profit.

Appended to the notes on the cultivation and curing of tobacco is the report of Mr. F. V. Chalmers, who visited Jamaica last year for the purpose of reporting on the prospects of the Jamaica tobacco industry. The matter has also received attention from the Director of the Imperial Institute, who advises that expert assistance be obtained from Cuba, or from Sumatra, or from Florida.

Mr. Chalmers expresses the hope that the production of cigar leaf wrapper will be largely taken up, as he is confident that 'there is a large fortune waiting for somebody who will only produce this tobacco as herein indicated.'

Particular interest attaches to the announcement made in Appendix II to the effect that an attempt is being made to introduce the use of Jamaica tobacco in the navy. Should this tobacco find favour with the sailors, it is probable that a considerable impetus will be given to the tobacco industry in this part of the world. Every effort will have to be made so that a regular and constant supply be forthcoming to meet the demand that would arise from this source. This is a matter to which careful attention must be paid by both tobacco growers and merchants in order to establish the industry on successful lines.

D. MORRIS,
Commissioner of Agriculture for the West Indies.

Barbados, November 29, 1905.

The Tobacco Nursery.

Selection of Site.—Select an open space quite devoid of shade of any description, and with a south or south-eastern aspect if possible; bill off the bush and spread same out to dry; when dry, rake up and put on one side.

Preparation of Beds.—Hoe off and clear away the grass, roots, etc. from the space thus cleared, and then proceed lightly to fork up the land, taking care not to turn up the sub-soil; when this is done peg out and line off the beds, allowing 3 feet for the bed and 4 feet for the path; now with a spade or shovel lift the loose soil from the 2 feet of the middle of the path, to the depth of four or five inches, and place it upon the bed and level down with a rake; the paths will then be 2 feet wide and 3-feet beds will have a long slope on either side.

Burning.—If the soil be light (sandy or loamy) and not likely to cake down after rain, it will be necessary only to burn, say, 5 or 6 inches of rubbish over the bed, just sufficient burning to destroy caterpillars, etc.; but if the soil is of a heavy, clayey nature the beds must be burned twice, each time spreading about 2 feet of rubbish on the beds; the ashes to be mixed with the surface soil after the first burning, and in either case before the seeds are sown. A seed bed ten yards long will yield ample seedlings for one acre of land.

Time of Sowing.—The best time to sow is about the middle of August; the suckers would then be ready for planting out during October. After this main sowing it is, however, very necessary to sow a few beds every fortnight, for the purpose of keeping up a supply of plants in the event of continued heavy rains interfering with the planting out of those that are just the size for planting; in which case they overgrow and become useless.

Sowing.—Mix the seeds with twice their bulk of fine sand or wood ashes and scatter evenly over the bed (including the long sloping sides) when the air is still; water with a fine-rose watering can, and keep the bed moist until the 'seedlings' are ready for hardening off before planting.

Shading.—Immediately after sowing, cut some forked sticks and rig up a skeleton arbour about 4 or 5 feet high and lay some long Guinea grass or coconut leaves over it, with the stalks pointing to the north; this will secure the points of the grass or coconut leaves trailing over on the southern or sunny side. This covering serves two purposes—it protects the germinating seeds from the sun, and breaks the force of the rain during a heavy shower.

As soon as sufficient seedlings have made their appearance, remove most of the shade from the arbour; this stops the germination of seeds that can very well wait for a time; the visible seedlings should now be an inch or so apart. When these have begun to develop their third leaf, remove the whole of the shade.

Weeding.—Pick all weeds as they appear, as, if allowed to get big before they are pulled out, the tobacco seedlings come out with them.

Hardening Off.—Four weeks after germination the seeds will begin to pack up together, covering the soil; they should now be gradually hardened off by keeping them on the dry side, watering them only when there is danger of the leaves drooping. In seven weeks from sowing they will be ready for planting out.

Damping.—Sometimes a shower of rain will bruise the young plants, inducing 'damping' in some places; to prevent the spread of the 'damping-off' fungus, apply a dusting of slaked lime to the affected parts of the bed.

Summary of Nursery Work.

Select a southern aspect for nursery. Secure the destruction of caterpillars and a loose, uncakable soil by burning. Sow the seeds thinly and evenly. Keep them moist and protected from sharp sunlight and heavy rain during germination.

Remove the shade gradually as soon as sufficient seeds have been germinated, *e.g.*, an inch apart. Keep down weeds and continue the watering until the plants pack up together. Gradually withhold the water to ensure the seedlings being hard when planted out. Look out for damp after a shower of rain.

Planting.

Time for Planting.—There is a certain short period towards the end of the year in which tobacco plants, whether in the beds or in the field, grow and develop at an exceedingly rapid rate; namely, from the last week in October to the middle of December; the success of a crop depends very largely on whether the main lot of plants is set out before this period or not; if not, then the plants will not be full developed by the time the dry ripening weather comes on. The main point is to make the best possible use of the latter half of the October 'seasons' with a view to growing large plants and leaves that will be ready for the dry weather when it arrives.

Soil.—The best soil for tobacco is a rich vegetable mould containing just sufficient clay to enable it to hold moisture for a good length of time; it can be taken as a maxim that the richer the soil is and the quicker the tobacco grows the better will be the quality of the cured product. Tobacco grown in a poor, gravelly soil at a hot, dry time of the year is so rank and heavy with narcotic gum that it is almost unsmokable; it makes, however, a first-class insecticide.

Situation of Plantation.—Tobacco should not be planted in districts where there are no well defined wet and dry seasons; it matters not how well the plants are grown, how carefully they are tended, if the two or three weeks' continuous sunshine and dry atmosphere be not forthcoming when the plants reach the ripening stage.

Preparation of Land.—The land on which it is intended to grow tobacco should be cleared of all trees and other objects that are likely to shade the plants; it is not necessary to grub the stumps out except for convenience in ploughing; the rubbish should be burned in heaps and the ashes scattered over the soil to be ploughed in. Where tobacco is grown every year on the same land the growth of cow peas or other leguminous plants between the crops is highly beneficial; the velvet bean seems to be the best for this purpose, for besides storing nitrogen in the soil, it climbs over and kills out any weeds that attempt to grow, and goes down itself quite easily before the disc harrow at ploughing time, reducing the cost of preparation very considerably. The seeds may be sown at any time during June and July, two or three in shallow holes 3 feet apart, more or less. Tobacco land should be broken up and

cultivated as thoroughly as possible; the least that can be done is to plough, cross-plough, harrow, and cross-harrow; as the rows have to run north and south, it is as well to plough in this direction first, finishing up with the cross-harrowing from east to west; this small matter makes it more convenient to arrange the lines when planting out.

PLANTING.—Two days before planting is to be commenced the nursery beds should receive a thorough soaking with water; the plants can then be got out without damaging the roots. Planting boxes, each capable of holding about 1,000 plants, should be prepared beforehand; these may be made out of any light wood, the most convenient shape being that of a square coal-scuttle or sugar scoop, 15 inches by 2 ft. 3 inches on the longest side; the seedlings are stacked into the boxes just as they come from the bed and are not disturbed until they are planted in the field; each planter should have a box, and there should be several spare ones so that the planters may be kept supplied with newly filled boxes from the nursery as the others get empty; the idea is to prevent the roots being exposed or damaged in any way.

The seedlings are ready for planting out when they have three or four leaves about four inches long and a hard stem from two to three inches long; care should be taken when lifting them from the beds not to break off the tap root as such a seedling often results in a curly-leaved plant. The best time of the day for planting is from three o'clock in the afternoon until dark; but this is because the plants are enabled to lay hold of the soil before they have to face the strong sunlight; so that advantage should be taken of cloudy days to push ahead with the planting as rapidly as possible. If the plants loose their first leaves by exposure to bright sun, they usually take some time to recover and make fresh ones before they can start into rapid growth; whereas if these leaves get safely through the transplanting, the plant starts into vigorous growth immediately.

In the actual planting out great care should be exercised in organising the work in such a way as to prevent a hitch occurring, to cause loss of time. After repeated trials of various methods I have found the following to be the best and quickest:—Procure eight stout pegs and two rough mallets; put four pegs into the ground on each side of the field at a distance of three feet apart and stretch lines between the first two pairs; start one man with a six-pointed dibbler from each end to make the holes, with one man following each to fill the holes with water as they are made, whether the soil be moist or dry; three planters may follow each waterer.

Care should be taken to see that the roots are put into the mud formed by throwing in the water; to secure this, thrust two fingers in the centre of the small puddle and draw half on one side; insert the roots, then press the moved half back again to the plant and smooth down the surrounding soil; no water will be required after this.

As soon as one line is holed and planted it can be moved to the next pair of pegs over the one on which the planters are working; the pegs may be moved in the odd moments whilst the planters are changing over from the finished line to the one newly holed and watered.

This is a brief outline of a plan that may be modified to suit varying condiions; for instance, the water may be some distance off, necessitating more hands in this part of the work; and again, women can apply the water just as well as men. A dibbler, capable of making six holes at once, can be very easily made out of two inches by three inches pitch pine scantling:—six 3-feet lengths planed smooth and pointed with iron held fifteen inches apart by a hand bar at the top and a foot bar one foot from the points; the lengths should be fifteen inches from centre to centre, that is, from point to point. An acre of tobacco planted three feet by fifteen inches should contain 11,600 plants; these in a fair season will yield about ten quintals of cured tobacco, equal to 1,000 lb.

After Cultivation.—About two or three weeks after planting, according to the state of the weather, the young plants will have put out some fresh leaves; and it will be noticed that each new leaf will be larger, when developed, than the one immediately below.

If the weather has been dry, suckers will very quickly make their appearance at the junction of the stem with the leaves. These should be removed at once. If, on the other hand, nice moist growing weather has prevailed, suckers will not become troublesome until the plant reaches a height of two feet to three feet; until, in fact, it is topped. Care should be taken from the first to keep down weeds, but avoid, if possible, trampling on the soil when it is wet; it is better by far to allow the weeds to remain until the surface of the soil is dry than to trample it into mud. During dry weather the surface of the soil should be kept loose by the use of the hoe, or a small cultivator drawn by a steer, to prevent the escape of the soil moisture.

Moulding.—When the plants are about a foot high, there is some danger of their falling over; advantage should be taken of the first spell of dry weather to give them a light moulding; this will also cover up the roots that come out during wet weather on the surface near the base of the plant, and protect them from the sun and dry wind. The easiest and best way to mould is to hoe a little soil out from the centre of the three feet space between the rows and scatter it evenly over the distance from there up to the plants; the workman walking in the 3-feet space and using the hoe left-and right-handed alternately. This method should be insisted upon, as, by moulding each row of plants separately, there is danger of breaking the leaves and of cutting the roots that are extending towards the middle of the 3-feet space.

Avoid making a high, sharp ridge when moulding, for it is a veritable death trap to the plants; they will grow well only as long as there is a large amount of moisture in the atmosphere, but will stop suddenly as soon as the air gets dry. The fact is that the plant has been encouraged to put out roots high up the stem, and on that account has discarded the deeply-laid roots. In such a case, a few day's dry wind is sufficient to absorb all the moisture out of the ridge that is so much above the surrounding level, with the result that the roots contained therein, on which the plant has been depending for its sustenance, very quickly become useless through lack of moisture. The ridge should be low and broad, extending from the centre of one interval to the centre of the next. To enable the workman to place the mould right up to the stem of the plant the small leaves at the base are removed. A No. 1 hoe is the best size for moulding tobacco.

Topping.—Each successive leaf is larger than the one just below, up to the eighth or ninth; the next four or five are about the same size, and those developed afterwards get gradually less until those near the infloresence are nothing more than small scales. One object in topping is to ensure all the leaves ripening at the same time, so that the whole plant may be cut; this only happens when the plants are topped down to the last developed large leaf, *e.g.*, the top one of the four or five that are the same size as each other.

Some practice is required to be able to judge just where to top the plant as these leaves have not yet developed; the best way at first is to top down to the twelfth leaf from the bottom those plants in which the flower bud is just discernible, not counting those leaves that were removed in the moulding.

In poor, sandy soil, planted late, only eight or nine good leaves per plant will be obtained, but in rich soil under the best conditions as many as fifteen good leaves have been secured per plant.

Suckering.—The topping is the signal for a sudden burst of suckers from the axils of the leaves, those at the top being the quickest to develop. These

suckers must be removed as soon as it is possible to lay hold of them conveniently, care being taken not to leave a single one on any part of the plant; remove every vestige of a sucker right down to the ground. If one is left it will be benefited by the removal of the others and grow at a prodigious rate.

If the weather is moist the suckering can be done at any time of the day, but if dry, hot days obtain, the suckering is best done in the morning, as the suckers are brittle and snap off easily; whereas in the afternoon they become leathery and difficult to remove without injuring the good leaves.

About ten or fourteen days after the first suckering another lot of suckers will appear; these must be removed in the same way leaving two only that are growing out of the stem below the surface of the soil, these are called the first 'ratoons,' to distinguish them from the plant which is called the 'principal.'

RIPENING.—Seven or eight days after the second suckering the leaves will begin to ripen; the first to do so will be, of course, the bottom or oldest leaves and the last the top ones. The first sign of ripening will be a crimpled appearance in the leaf, somewhat like a savoy cabbage but not so pronounced; the next is that the leaves turn a light green; which on closer examination will be found to be caused by a yellow shading at the summit of each little bump or crimp. The leaves then become thick and leathery, and the minute hairs lose their glistening appearance and in some cases the edges turn down.

If the plant is topped properly, it will be ready to cut when the lower middle of the top leaf is ripe, this being the last spot on the whole plant to ripen. It will thus be seen that it is possible to judge a day when the plant is fit to cut.

RATOONS.—There is a saying among the Cubans that the price obtained for the 'principals' covers the cost of the cultivation and curing of the whole crop the 'ratoons' representing net profit. The former are sold as 'capa' (wrapper) but are used for 'capoti' (binder) in the best cigars, for which Sumatra wrappers are used, and as wrappers for cheap cigars; the ratoons are used for 'tripa' (filler).

By good management is is, however, possible to obtain excellent capa leaves from the first ratoons; more especially when the principal ripens up quickly and is cut in time to allow the ratoon leaves to develop in the full light. The ratoons require the same attention as the principals with regard to weeding, moulding, tapping, and suckering, again leaving one or two ratoons, according to the strength of the plant, to take the place of the ripe ratoons when cut.

The cutting may go on in this way until the leaves produced are so small as not to be worth the expense of cutting and hanging.

Whilst the planting operations are proceeding, some attention should be given to the curing house in the way of preparing it for the reception of the crop; if no curing house exists it will be necessary to build one, and if this is contemplated the following simple directions may be found useful.

(To be Continued.)

EXPERIMENTS IN CURING TOBACCO IN MADRAS.

Madras is justifiably proud of her cheroots, but nobody would venture to say that the local tobacco industry is incapable of improvement. The Government of Madras, in their anxiety to improve the quality of the tobacco produced in this Presidency, more especially as regards the operation of curing, have had under consideration two schemes (1) the employment of a curer from Jamaica, and (2) the careful curing, under Messrs. Spencer and Co.'s supervision,

of leaf specially selected in the field. As regards the first, it was postponed on the Deputy Director of Agriculture pointing out that no good purpose would be served by obtaining a curer from Jamaica, "as the curing, etc., of tobacco must be so very specially worked out according to local conditions," and moreover it would be better to await the arrival of the Tobacco Expert for India, the employment of whom the Government of India have already sanctioned. The experiments under Messrs. Spencer and Co.'s supervision were, however, proceeded with during the year 1904-05. But the season, owing to scarcity of water, was so unpropitious and the consequent quality of the leaf so unsatisfactory that Messrs. Spencer and Co.'s Manager considered that there was no reasonable hope of successful curing experiments being carried out during the year. Notwithstanding those drawbacks Messrs. Spencer and Co. secured from the tobacco leaf purchased from selected gardens by the Agricultural Department a high quality of cured leaf by paying careful attention to detail in fermentation; and the leaf so cured was allowed to mature for more than the usual period with a view to determine whether any improvement in flavour and burning quality could be attained thereby.

The experiments resulted in three small boxes of cheroots, which were forwarded for inspection to the Board of Revenue. The latter have asked for a report from Messrs. Spencer and Co. on their quality, and also intend obtaining an opinion thereon from other local experts. Mr. Benson believes that whilst great success has been obtained with regard to the appearance of the leaf, it has not been attained with regard to flavour and burning quality. On these last two points, however, he thinks that it will be well to wait some time to allow the leaf to mature further. Considering all the circumstances, we are glad to note that the experiments are to be continued, and that if success is attained a full account of the method of curing adopted is to be made available for the information of the public.—*Madras Mail.*

THE RENOVATION OF DETERIORATED TEA.

By H. M. Mann, D.Sc.

At any moment during the past twenty years the question of the treatment of old and deteriorated tea has been an anxious and much-discussed problem over almost the entire extent of tea districts of North-East India. In fact it is no new observation that under the conditions of tea culture in India, the bushes rapidly lose the vigour of their early days and, after a time varying from ten to twenty years from planting, may be said to have passed their prime, and can only be kept from deteriorating by very careful treatment.

HISTORY OF THE SUBJECT.

This fact, due in part to the unnatural conditions under which the tea plant is cultivated, became very obvious in the very early days of the industry. Though the first gardens only date back at the most to the late thirties (1835-1840), yet before ten years were past, as the records of the Assam Company show, complaints were made that the older planted areas had begun to yield less than they had done when younger, and less than was expected. Of course, we now know that deterioration such as this was largely, if not entirely, due to a vicious system of managing the bushes and collecting the crop, but the fact remains. By the later sixties (1865-1870), some of the planters had commenced to talk about the necessity for manures, but the question was not taken up, and a few tests with fertilisers not having been very successful, their use as a method of dealing with deteriorated tea was put almost entirely on one side for over thirty years.

Owing to the very expensive character of manuring and to its very partial success at that time, it became the rule in many districts to make up for the annual deterioration of the older tea by planting new areas every year. Thus it was often the case that five or even ten per cent of the existing area was put out in new plant each year, with the idea that as soon as the new tea came into bearing, a corresponding area of old cultivation should be abandoned and allowed to revert to its original jungle. Sometimes the abandonment was carried out; sometimes, and often, the old cultivation was still retained in the area of bearing tea. The former, while agriculturally a disgraceful process resembling the jhuming system of the Indian hill tribes, was commercially sound; the latter, in constantly increasing the area under cultivation while the yield did not increase or only increased in a smaller ratio, was both agriculturally and commercially unsound. That this is the case is sufficiently obvious with the least thought. There is a constantly increasing area, demanding a constantly augmenting labour force both for cultivating the land and plucking the crop, and a crop not increasing in the same proportion, and hence costing more per pound each year. The result has been, ultimately, a crisis in many gardens, and the method is now almost entirely a discredited one.

While such methods of counteracting the deteriorating effect of age in tea gardens and tea bushes were being used, the discovery was made that bushes, which had gone very far below their original condition could be brought again into vigorous yielding condition by 'heavy pruning.' By this type of pruning is meant any system which involves cutting out entirely the growth of shoots made in the current year, and so leaving on the bush only wood more than one year old. The tea bush has a marvellous power of throwing out new shoots at apparently almost any point of the old wood on the plant, so that when all the younger wood is cut out, new shoots make their appearance from the older growth, and provided the soil is in a satisfactory condition and not exhausted this growth arising from the older wood shows greater size and vigour than that produced on the younger shoots only grown during the previous season. The advantage of this was quickly seen. By periodical 'heavy prunings' it seemed as if it would be possible to keep old bushes in full vigour indefinitely. The 'heavy pruning' conducted under the influence of this idea became, 'year by year" heavier and heavier, and until in the early nineties (1890–1895) it became fashionable in Upper Assam actually to cut down to the ground any tea which had deteriorated in yield, and allow new shoots to come from the 'collar' of the plant or even below. This was called 'collar pruning.' Advantageous and even necessary as such treatment was in many cases, the system just described took a far too great extension. Hundreds of acres were collar-pruned when the tea was suffering from causes for which collar pruning was no remedy, and it was hardly recognised enough that such drastic treatment should only be adopted as an extreme, and then only when quite evident that the deterioration was due to something for which collar pruning is a remedy.

The present state of the subject is then somewhat as follows. The old tea throughout the Indian tea districts in North-East India has mostly declined or is declining in value. There is comparatively little plant more than thirty years old which does not show this decline; and much, the age of which only little exceeds twenty years, is in the same case. The older system of abandonment of the old areas and planting out new to correspond, cannot in many cases now go on owing to the lack of available land, and the essentially wasteful character of the method is becoming more and more realised. The planting of additional areas in a garden to make up for the decline of the old tea has been generally recognised as being

commercially unsound. The renovation of old areas by heavy and collar-pruning, though still adopted, and rightly adopted in many cases, has been proved not to apply under all conditions. Manuring is, as yet, in its infancy as a practicable and regular method. The time is therefore opportune for a discussion of the whole question as to the special cause of deterioration, the signs by which each of them may be recognised, and the methods which have hitherto proved, both in experiment and in practice, most competent to stay the decline in the yield and quality of older tea, and of thus maintaining the value of our older areas,

SIGNS OF DETERIORATION.

It is not always, however, that the decline in value of a block of tea is recognised until it has already got into a very bad condition. Until recently the keeping of records for each section of a garden was the exception rather than the rule, and, without this, it is almost impossible to recognise the first drop from the original yield. I well remember visiting a garden in one of the districts of Assam some years ago, which had been making brilliantly successful years, and was looked upon as one of the show places of the district in which it lay. The yield had been keeping up, or rather its decline had not been noticed owing to the exceptionally fine returns which were being given by young tea newly in bearing. And yet the bulk of the older tea was undoubtedly rapidly deteriorating. Luckily, the matter was recognised in time, but I quote this as an example of how brilliant results may sometimes hide the commencement of serious mischief.

But what are the first indications by means of which deterioration in tea may be at once recognised? The resultant loss in yield is usually by no means the first sign, for this can be often maintained by harder or closer plucking or other means for some years after deterioration has set in. Probably the first point noticeable in most cases is the change in colour of the bushes. Thoroughly vigorous tea even if of the light coloured jats, has a darker appearance than unhealthy plant, and the leaves have an oily appearance very difficult to describe but which can hardly be mistaken. Then, too, the whole surface of the tea, at the beginning of the season, seems to be growing; the outer parts of each bush show that each shoot is throwing out new growth which is itself vigorous and with the oily appearance already stated. On the other hand, if the general colour of the tea in the season is an unhealthy yellow, if the difference between the vigour of the growth (in March or April) at the outside of the bushes and in their centres is great, if the shoots, which do appear quickly cease growing and turn banjhi, then it is time to consider the cause of the decline which has maifestly commenced. In nine cases out of ten tea which presents these signs will, if examined in May or June, be found to be attacked by Red Rust (*Cephaleuros virescens*), a sure indication of weakness in the bushes all over tea districts. If this is the case, the yellowish colour of the bushes will, at that time of year, be interpersed with many shoots bearing variegated leaves. These shoots are practically always 'banjhi,' and if the second year's wood from which they rise be examined, it will be found almost always to bear the characteristic fruiting organs of the alga which is known as 'red rust.'

Tea, which has the unhealthy colour just described, and has red rust in any large amount, is evidently beginning to 'go off,' and the result will sooner or later be seen in thin flushes and loss in yield. And in this connection may I enter a plea for the universal adoption of a system of records of the yield of each block at every plucking on all gardens? I know such records are being increasingly adopted, but until this system is universal there is always the chance of a planter or a tea company living in a fool's paradise until a crisis occurs and several unprofitable years follow before the tea is brought into a yielding condition again. Loss in yield

should be capable of immediate check, and the cause ascertained at once and remedied, if a garden is to be kept up to the mark under the high pressure conditions of modern tea planting.

Accompanying the decline in yield the appearance of the wood on a bush usually changes. There are grey lichens on the stems of nearly all tea bushes, but they only occupy part of the surface; in unhealthy plants these lichens seem quickly to spread over the whole, giving the wood a peculiar greyish appearance which is generally described by the term 'hide bound.' Though this term has no definite scientific meaning, yet in a 'hide bound' bush the bark always seems distinctly harder than on a thoroughly healthy plant. The most characteristic feature is, however, the fact that leaf growth seems to cease in large measure except from the younger wood on the top of the bushes. The result is that a 'hide bound' bush always looks hollow, and while it may appear fairly vigorous on the top, an examination below indicates the unhealthy condition in which it really is. The usual and often the right prescription for such bushes would be heavy pruning. This is not, however, always the case as will be realised later.

CAUSES OF DETERIORATION.

We have described the most obvious signs of an unhealthy deteriorating bush, and the special causes which produce such unhealthiness must next be considered. Deterioration in tea, apart from incorrect management, must be due either to exhaustion of the land, or exhaustion of the bush, and it has been a common subject of discussion among planters as to which is usually first noticeable. It seems now clearly proved that the question does not admit of a definite and generally applicable answer. In many cases, and in my experience notably in the Duars, the bushes show signs of being worn out long before the soil could be considered exhausted. In others, the marvellous results obtained by adding manure to the land, without any further treatment, show beyond cavil that the bushes would yield and continue in good health if only the soil was rich enough, or the plant food present in an available condition. I am strongly of opinion that in by far the greater proportion of cases it is the exhaustion of the soil, coupled with incorrect treatment of one sort or another, which brings about the first decline in the value of areas of tea. At any rate it is no use touching the bush until one is certain that the soil is in good enough condition to enable the bushes to respond to the treatment. But how to ascertain whether there is anything wrong with the soil?

DRAINAGE.

In the first place, it should be made certain that the drainage of the land is satisfactory. This, I think, can be done on the spot by three or four tests. These tests concern (1) the moisture in the subsoil in the cold weather, (2) the depth of the subsoil water in the drains, (3) the rapidity with which the heavy rains disappear through (not over) the soil on a piece of flat land. With regard to the first of these matters, it can easily be tested by digging a hole two feet deep, weighing say, ten pounds of the damp soil at the bottom of the hole, drying it in a warm place near the boiler for say two days, and reweighing. Now the maximum amount of water which ten pounds of different classes of dried soil can take up when saturated is approximately as follows :—

Sandy soil	...	...	...	2·25	pounds.
Light loam	...	...	...	3·04	,,
Medium loam	...	...	...	3·22	,,
Heavy loam	...	...	...	3·32	,,
Clay soil	...	...	...	3·85	,,

If, in the cold weather, the subsoil between two and three feet deep contains more than one-third of this amount (or perhaps one-half with a sandy or light soil) calculated on the dried soil, it will be most probably waterlogged in the rains, and needs subsoil drainage badly. The next test can be still more easily applied by digging a hole in the land after rain has been steadily falling for some days at the height of the monsoon. If, at this time, the water is within three or even four feet of the surface, a case for immediate deep drainage has been made out. A still further test depends on the rapidity with which the water falling on the surface disappears into the land. Observation on this point is only valuable after there has been much rain for some days, and the soil is thoroughly wet. In any case two hours after the rain ceases, the surface should be free from standing water.

If the land answers satisfactorily the tests above set down, I think that it may be concluded that the cause of the deterioration lies elsewhere than in the drainage; if not, systematic drainage must be undertaken. It would lead us too far to go here into the methods by which the drainage must be done, and for this I must refer the reader to the chapter on the drainage of tea gardens in "The Pests and Blights of the Tea Plant" (second edition,) by Sir George Watt and the writer, published in 1903.

PHYSICAL CONDITION OF THE SOIL.

But if the drainage is satisfactory, is the physical condition of the soil and subsoil as it should be? In other words, is the soil in good 'tilth' not merely on the surface, but for some distance into the land as well? If not, is the nature of the soil to blame, or is the condition solely due to lack of adequate cultivation? The first test to be applied in this connection is pressing of a stick down into the land. It will most likely be easily forced in to the depth of four to six inches in any garden, but in one where the soil conditions are good there should be no trouble in driving it by pressure of the hands alone to eight or ten inches, and sometimes even to fifteen inches deep. If such a stick shows evidence of a hard layer (otherwise 'hard-pan') at a depth of less than ten to twelve inches, it is evident that the condition of the soil needs improvement. A second test is furnished by the condition of the roots themselves. If they are flattened out, if all the rootlets which tend downward become rapidly small and stunted, if the whole rootlet development is a surface one, this affords a strong reason for supposing that the subsoil conditions need improvement in a physical sense.

The soil improvement needed may be merely more and better light hoeing In quite a number of tea estates, in the Duars for instance, which have come under my notice, and where the tea is said to be 'going back,' this is almost certainly the case. The precise cause of the effect which this light cultivation produces on the bushes has never been entirely explained. Its primary object is, of course, always held to be the burial and destruction of jungle growth. But it must do more than this, for, in places as we have noted above, where jungle growth is very small, the effect of lack of cultivation is equally obvious in a rapid yellowing of the bushes and a speedy increase in disease. In a large measure, no doubt, the cultivation is useful because it keeps the surface soil loose, and allows the tea rootlets thus easily to push through it. There is, we fancy, something even beyond this. In heavy soils, at any rate, there is always a large amount of plant food in the soil that no plant can use, as it is not in a condition in which it is absorbable by vegetable growth. This becomes only gradually available in the soil when it is exposed to atmospheric influences. A large quantity of the phosphoric acid and potash in heavy soils is usually in this unavailable condition, and it needs the exposure caused by the regular hoeing to make them ready to be absorbed by plant life. This is the more probable because as land gets older and longer under tea,

cultivation becomes more and more necessary to maintain vigour in the bushes, and a garden which will in its early days do well with four light hoes per annum, will ten years later need six or seven to give anything like equal results.

While on this point I cannot refrain from referring to a controversy which has recently arisen, as to the value of hoeing a garden in the latter part of a season, say from August onwards. My own idea is that such cultivation is extremely valuable, and this largely from considerations not of the results for the season in which it is done, but rather of the following one. It may generally, I think, be said that any lack of hoeing in the latter part of one year is likely to be felt in poor thin weedy growth at the beginning of the following season.

Quite as often as it is the result of deficient light hoeing the deterioration in the tea is directly caused by poor shallow cold weather cultivation, or by this cultivation being done very late. One can hardly too strongly insist on the importance of the cold weather deep hoeing. If done deep enough, it makes the lower layers of the soil friable, and hence penetrable by the delicate tea roots. It causes the retention of a large quantity of moisture during the dry season in the subsoil for the use of the plant, which would otherwise be lost. Very frequently indeed the non-luxuriance of a tea estate can be traced to scamping of the cold weather deep hoe or to its being left too late.

While adequate cultivation can be obtained by hoeing of various kinds, this does not make the deeper subsoil friable and penetrable for the tea roots as it should be. This can only be done by growing deep-rooted trees and plants in among the tea. To this subject we will return a little later in dealing with green manuring.

EXHAUSTION OF PLANT FOOD.

But the land may be well drained and cultivated, it may be in good physical condition to a sufficient depth, yet if it is exhausted of plant food, these will count for little, and manuring in one form or another will be essential. This state has been reached in many Assam gardens, and can be judged on the spot fairly well by several indications. The first of these is the character of the green herbage. Wherever, for instance, 'ilami' 'cold weather weed' (*Ageratum sp.*) grows vigorously, the soil is not exhausted; and the same may be said of quite a number of the common weeds of tea. A short, stunted herbage, principally of small grasses, on the other hand always looks bad, and seems to indicate exhausted land. A little examination of the jungle on good land and on the old areas of a garden will very quickly show the difference in the character of the weeds on which I wish to insist. A second and excellent test of the exhaustion or otherwise of a tea soil is obtained by trying to grow mati kalai (*Phaseolus mungo*) upon it. If this be put into well hoed, slightly moist land, at the end of April or the early part of May, and it is not ruined by very heavy rain, the vigour of its growth may be taken as a very fair measure of the condition of the soil in this respect. If it flourishes and grows two feet high or more in six or seven weeks, the soil is good enough for the time being; if not, it is probable that manure is required before the tea will reach what it ought to be. A third indication of the exhaustion of the surface soil is given by a gradually increasing difficulty in retaining good tilth on the surface of the land. The condition of the soil largely depends on the amount of organic matter present, and when this disappears through long growth of a crop, the tilth suffers, and the surface after hoeing often quickly forms a hard-baked layer of soil again.

The last and ultimate test of exhaustion is analysis of the soil. It is necessary to urge tea growers, however, not to depend too much on the indications which this gives, for soil analysis even in its most modern developments is essentially

a very clumsy means of finding out the real richness of the land. But if all the indications above named give results tending to show that the soil is exhausted, it will probably be wise to have the soil examined by a chemist, in order to determine the most economical way of applying the manures which they have shown to be necessary.

Limits of space do not allow me here to go into the question of the manures adapted to special soils and special conditions. Suffice it to say that where the principal deterioration is in luxuriance, there the most important manure constituents will usually be organic matter and nitrogen, and these can best be supplied by top-dressing with good bheel soil, if available, by cattle manure, by oil cake, or by green manure. If deterioration in quality is chiefly to be treated, manure containing phosphates appear of the greatest importance. There is one class of manure whose effect has proved very great under many conditions, and the application of which costs very little—I mean green manures.

GREEN MANURES.

First and foremost of these in the Indian districts come the leguminous trees, of which the *Albizzia stipulata* is the chief. They not only manure the soil by their leaves and roots, but also improve the condition of the land in which they grow. Their effect is little seen during the first three years or so of their life, but as they become mature they produce a dark healthy colour on the tea all round them which is quite different from the remainder of the blocks in which they are planted. The best practice places them sixty feet apart throughout the tea and keeps them well lopped so that they do not overhang the tea bushes.

In the second order come the leguminous bushes, of which the only one hitherto tried on an extended scale is the boga medeloa (*Tephrosia candida*) which has given excellent results both in Assam and Sylhet. A few seeds, generally three or four, are planted on a small heap between alternate bushes in alternate rows in April or May, and protected from the hoeing coolies by a tripod of three sticks. By the end of the season the bushes are seven or eight feet high, and from this time the whole should be kept trimmed to a narrow shape, and everything that is pruned off buried with the hoeing. This trimming should be done four or five times every year, and may well de done before every round of hoeing, and the material be buried with the hoe. The bush should be kept so that it does not interfere with the pluckers, nor materially shade the tea. At the end of three years the whole plants are pulled up, and buried in trenches between the rows of tea. This method has, as has already been said, given good results on light land, and the increased vigour in old and deteriorated tea has quickly shown itself in the yield, as well as in the appearance of the bushes. The boga medeloa has the special advantage of growing in very poor light soils, such as would not grow any crop of almost all the other green manures which have been tried.

In the third rank of green manures stand the annual crops which are grown for a short time on the land and then hoed in as a whole. In India, very great results have already been obtained by the use of mati kalai (*Phaseolus mungo*), which is sown broadcast on the land at the end of April or the early part of May, and hoed in at the latter part of June or the early part of July. It is found unwise to allow it to remain on the land more than about eight weeks. During 1905, equally good results have been obtained on an experimental scale with the other plants, *Crotolaria striata* (the crop principally used for this purpose in Ceylon) dhaincha (*Sesbania cannabina*), a common crop of Lower Bengal. Each of these remains on the land eight to ten weeks, and is then hoed into the soil. The effect seems partially due to the considerable improvement which they always effect in the texture of the land, and partly to the very large amount of nitrogen which

they take up from the air by means of their root nodules, and so make it available as plant food for the tea. The trouble with each of them is that they will not grow on very highly exhausted soils, and in such cases demand a small quantity of cattle manure (say two tons per acre) to give them a start, after which they will grow luxuriantly.

DETERIORATION OF THE TEA PLANTS.

We have dealt with the methods by which deterioration of tea due to defective soil conditions or to soil exhaustion may be treated. We cannot too much insist that in any case of manifest decline the soil should be the first thing looked to, and heavy or collar pruning of the bush only adopted after becoming sure that the fundamental mischief does not lie in the exhaustion of the land. But if this is certain then the bush itself should be examined, and the cause of the decline most probably will be found there. The causes of the deterioration of a tea bush seem to be inseparable from the methods of culture. When a tree, usually eighteen to twenty feet high, is kept to four feet as a limit; when every green shoot which it throws is nipped off more or less closely; when the annual pruning of the youngest grown wood renders the course of the sap in the plant continually longer and more circuitous; it is only natural that sooner or later (the time depending on the vigour of the bush, and this on the richness of the land), the plant will begin to decline in yield, that the younger shoots will become less energetic in throwing out new leaves, and that the tea will begin to deteriorate.

The result obtained is in accordance with this expectation, but there are methods of culture which hasten the day of decline, and which have made many gardens begin to 'go off' before the time they need have done. The earliest and still the most frequent of these is probably too hard plucking in the early part of the season. It is well known and well recognised that if a bush is to continue healthy and yielding, great care must be taken with the first and second series of shoots in the year, but, even yet, I am confident that anxiety to make tea in May and June is at the bottom of the rapid decline of many a good garden. The growth which is allowed to remain on the bush immediately after pruning is left for three reasons. First, in order to provide wood for pruning, in the next year; second, to give the bush enough leaf growth to keep it well supplied with breathing organs during the season; third, to afford plenty of leaf axils from which the secondary shoots or "flushes" may arise. To provide for the second of these purposes far more growth is necessary than would be required to supply the first and third, and it is due to the non-recognition of this fact that the early pluckings have often been too close, and numerous evil results have followed and are following. In the latter part of the season when there is amply sufficient leaf growth to feed the bush, the young shoots may be plucked absolutely close as they grow, but to do so (in North East India) even under the most favourable conditions of growth till the beginning of July, is a policy which, though it may apparently do well on a young and flourishing garden for some years, will quickly bring about a serious decline in the value of the bushes.

The second principal hastening cause in the deterioration of tea bushes is incorrect pruning. The subject is too long a one to deal with here in full. It may be said, however, that in the past damage has been done by cutting too little out of the bushes, and in a less measure by cutting too much. The following points should, however, be noticed in pruning, and even if the process then costs more than it has usually been the habit to spend, the extra amount is well invested if the decline of the bushes is, by this means, delayed:—

(*a*) All dead branches should be removed.

(*b*) All gnarled twigs and 'crow's—foot' clumps of imperfectly formed shoots (otherwise, the previous year's banjhi flushing) should be taken out.

(*c*) All snags, which are seen to have little chance of healing over, might well be pruned off.

(*d*) All "trailing" branches at the outside of the bush are better away.

(*e*) All the previous year's horizontal shoots at the outside of the bushes should be headed back to induce them to throw out vertical shoots.

(*f*) All small twiggy shoots throughout the bushes, which will never give strong healthy wood for the next year, should be cut right back to the stem from which they arise.

(*g*) The amount of new wood left on each shoot should be as little as possible (generally not more than one and a half inches), consistent with this containing one bud, dormant or otherwise.

(*h*) The same length of new wood should be left on each pruned shoot throughout the bush.

Where deterioration of the bush has commenced, either in the normal course or hastened by incorrect pruning or plucking, there is one method of bringing it back to a healthy condition, provided always that the soil and the roots are in a thoroughly satisfactory condition. This is by 'heavy pruning.' Though more rational methods of annual light pruning will make heavy pruning necessary less often than it would be otherwise, and less often than it has been in the past, yet just as pruning at all is necessary to remove the refuse mass of twigs which plucking say, twenty or thirty times in the season, leaves in the bush, so heavy pruning is necessary to remove the refuse of several light prunings. But it is not merely a method of removing the refuse non-yielding wood from a bush; it also has an effect in directly stimulating the plant to greater exertions, and this is evidenced, if by nothing else, by the greater development of small-feeding rootlets after heavy cutting of the plant, provided the soil is such as to allow of their formation. This is probably one of the principal reasons in some cases why heavy and especially collar pruning has been such a great success. The bushes are a mass of useless wood, inadequate feeding of the root energies occurs, and little new root growth takes place. The bush is heavily pruned or collar pruned, and allowed to rest, when the whole of the new growth spends its time in feeding roots innumerable; new and valuable rootlets make their appearance, and the result is a magnificent bush, which, if dealt with properly, gives as good a plant probably as has ever been in the place before.

The amount of pruning required to stay deterioration is a matter which can only be settled by a practical man on the spot. There are, however, several guiding principles. In the first place, heavy pruning should not disturb, if possible, the shape and framework of the bush, and if it is necessary to cut so low down that this is destroyed, collar pruning is indicated. Secondly, as few knots as possible should be left below the cutting. Again, grey lichenous growths on a bush are a sign that the wood on which they are taking place must be cut out if it cannot be made vigorous by heavy manuring. Fourthly, it seems that in almost every case manure should be applied either before or at the time of heavy pruning, at any rate if the pruning is really low. It will stimulate the bush at a time when it has suffered a great shock and so should usually be given even on a good soil. Finally, the bush must be nursed and easily treated for a long time after the heavy or collar pruning is carried out, and in very low cutting it requires very careful cultivation, especially immediately round the stem of the bush.

TREATMENT OF VERY BAD TEA.

There may come a time in any garden, and it has already come in a few gardens in the older portions of Assam, where the methods hitherto mentioned seem insufficient to bring deteriorated tea back to a profitable and yielding

9

basis. The bushes have been collar pruned and heavy pruned until there is no opportunity for further work in this direction. Manure has been applied, but the result has not been profitable. Under these conditions what is to be done? Until recently the only answer has been to abandon the tea altogether. Objectionable as this may be, in some cases it is perhaps still the only policy, but experiments have been initiated in another direction during the last three or four years which will perhaps result in bringing back tea to a profitable condition which would otherwise fall out altogether.

Essentially the process is this. The bush is heavy pruned again, cutting wherever reasonably good wood can be obtained, the block is manured with say fifteen maunds of oil cake per acre or an equivalent amount of cattle manure, and then the whole is left absolutely unplucked either throughout the whole season or until August, September or even October, receiving its full share of cultivation, however, the whole time.

Under these circumstances bushes often produce thicker wood than they have done for many years, which can form a basis for future growth. Whether the rejuvenation of the bushes will be permanent is a matter of time to decide. The whole question is still in the experimental stage, but there seems a likelihood that by this means tea, which would otherwise have to be abandoned, may be again made useful and profitable.

CONCLUSION.

We have now dealt with the signs of deterioration, its causes, and the methods which seem best adapted for bringing back to a profitable condition much of the tea in India which has now declined from its former value. While much of the deterioration which has taken place in the past has been natural and the result of age, very much more has been the result of unwise treatment of either the soil or the plants. In conclusion it must be urged very strongly that in the matter of dealing with tea, prevention of deterioration is very much better than any cure. A little money spent in draining, in manuring, in cultivation, in more careful pruning or a little less feverish anxiety to take the last farthing out of the bushes in the way of yield (more especially in the earlier part of the season), will often prevent a crisis such as has frequently occurred in the history of so many tea concerns, To this aspect of the question I would most earnestly draw the attention of those gardens now in a flourishing condition, while the methods I have here suggested may well be applied by those in the less happy position of holding in their properties already deteriorated tea.—*Agricultural Journal of India,* April 12th.

THE CEYLON IMPORT DUTY ON TEA.

OFFICIAL CORRESPONDENCE.

Kandy, May 16.

SIR,—I hereto annex copy of correspondence with Government regarding the Ceylon Import Duty on Tea, and would ask you to kindly give it a place in the columns of your Journal for the information of those interested.

EDGAR TURNER,

Secretary, Planters' Association of Ceylon.

(*Correspondence referred to.*)

COLONIAL SECRETARY'S OFFICE,
Colombo, 3rd May, 1906.

SIR,—With reference to my letter of 23rd September, 1905, and previous correspondence regarding the Import Duty levied in Ceylon upon Indian Tea, I am directed by His Excellency the Governor to forward for your information copy of a Despatch received from the Secretary of State for the Colonies enclosing a copy of a Question and Answer in the House of Commons on the subject.

2. I am to observe that the object of the Ceylon Planters is, it is understood, to ensure, that no tea other than that grown in Ceylon is exported from the Colony as pure Ceylon Tea, and in this desire His Excellency considers that the Planters are justified. But His Excellency regards it as worthy of the consideration of the tea producers whether the object referred to could not be secured without prohibiting the blending of tea in Colombo in bond. Colombo is the natural centre of the world for tea blending, and if precaution be taken that all tea leaving the bonded stores is marked as blended tea in an unmistakable manner, it is not clear how the Ceylon grower can be injured. If Java or China teas are required for the market, they will go to Europe to be blended there as easily as they could be sent to Colombo, and in preventing the blending of tea here in bond the Ceylon growers seem to prevent the creation of an additional market, while Colombo is losing what would probably be a lucrative business.

3. His Excellency will therefore be glad if the Planters' Association will consider the points raised and inform him of their views on the matter.

I am, &c.,
(Signed) F. J. SMITH,
For Colonial Secretary.

The Secretary, Planters' Association of Ceylon, Kandy.

Downing Street, 4th April, 1906.

SIR,—With reference to your Despatch No. 118 of the 16th of May, 1905, I have the honour to enclose for your consideration a copy of a Question and Answer in the House of Commons on the subject of the Import Duty levied in Ceylon upon Indian Tea.

2. I would be glad to know whether your Government remains of the same opinion as a year ago, and still considers that the present restriction should not be relaxed, or whether the conditions of the case have been altered in any way.

3. As I understand, the object of maintaining the duty is to safeguard the purity of Ceylon tea, and the Ceylon tea growers seem to think that the encouragement to the blending of Indian and Ceylon Teas, which would be the result of removing or modifying the present restrictions, might benefit India at the expense of Ceylon, although some additional trade would be attracted to Colombo.

4. It is a matter on which local opinion must prevail, no Imperial interest being involved; but the present policy seems to be of somewhat doubtful value, and you may be of opinion that the time has come to reconsider it.

I have, etc.,
(Signed) ELGIN.

Governor Sir H. A. Blake, G.C.M.G., etc. etc. etc.

Kandy, 15th May, 1906.

SIR,—I am in receipt of your letter of the 23rd instant, covering a Despatch from the Secretary of State for the Colonies, on the subject of the Import Duty on Tea in Ceylon.

The subject has been before the Planters' Association and the Chamber of Commerce many times during the last few years. The majority of both bodies are of the opinion that the advantage to be gained by allowing the blending of all teas in Colombo is problematical, and the possibility of damage to the Producers' interest probable.

What precautions are the Government of Ceylon prepared to adopt to prevent inferior teas being imported for blending purposes, and what precautions to prevent blends being exported from Ceylon as pure Ceylon Tea? This in the opinion of my Committee would entail the establishment of a new department.

I am, etc.,

(Signed) E. TURNER,

Secretary, P. A. of Ceylon.

The Hon'ble the Colonial Secretary, Colombo.

THE CEYLON "THIRTY COMMITTEE" MEETING.

Minutes of a Meeting of the Thirty Committee at Victoria Commemoration Buildings, Kandy, on Saturday, (12th), at 7-30 a.m. Present :—Messrs. Jas. R. Martin, (Chairman), Hon. Mr. Edward Rosling, Messrs. Jas. Westland, G. H. Alston, Geo. Greig, R. Morison, D. Kerr, Herbert W. Unwin, W. L. Strachan, W. S. T. Saunders, Alex. Wardrop, G. C. Bliss, J. B. Coles, Alex. Fairlie, Joseph C. Dunbar, R. Huyshe Eliot, J. S. Patterson, N. W. Davies, W. Shakspeare, W. D. Gibbon, R. A. Galton, E. Turner, (Secretary). 22 Members.

MISCELLANEOUS.—Laid on the Table Petition from Messrs. McMeekin & Co. and memorial signed by A. Brooke and others representing 40,000 acres. to the Secretary of State for the Colonies. Resolved :—"That the Chairman and Secretary reply on the lines as drafted."

Laid on the Table Resumé of the work done by the Thirty Committee (printed). Submitted letters from Government dated 12th March and 2nd April, 1906, *re* Export Duty on Tea. Submitted formal correspondence.

MEMBERS OF COMMITTEE.—Read letters of regret from members unable to be present. Read letters from Mr. W. Forsythe, the Hon. Mr. J. N. Campbell, and Mr. W. J. Smith resigning membership of the Committee. Resolved :—That Capt. Gordon, (Passara), W. G. Sinclair, (Dimbula), and Mr. Wm. Sinclair, (Rangala), be asked to serve on the Committee in place of the above members who have resigned.

CARDAMOM CESS.—Discussed means of advertising cardamoms. Resolved :—"That the Secretary write to the Department of Commercial Intelligence, India, and to the Consuls in Japan, China, Formosa and Zanzibar." Intimated that the total collections to date amounted to Rs. 5,304-89.

FINANCES.—Submitted correspondence with the Hon. the Treasurer of the Colony and following statements of Thirty Committee Accounts :—

MEMO. OF THIRTY COMMITTEE ACCOUNTS.

From 1st January to 30th April, 1906.

To balance unexpended 31st December, 1905 ...	Rs. 155,486·46	
To Cess payments Jan-April, 1906	,, 167,652·06	
To Bank Interest	,, 791·67	
By Expenditure 1st January to 30th April, 1906		Rs. 189,994·70
By balance in National Bank ... ... ,,		,, 133,466·47
By balance of cash in hand ... ... ,,		,, 469,02
	Rs. 323,930·19	Rs. 323,930·19

CESS PAYMENTS.

January, 1906 ...	Rs. 44,731·88	April, 1906 ...	Rs. 43,658·23
February, ,, ...	,, 48,086·55		
March, ,, ...	,, 31,175·40		Rs. 167,652·06

STATEMENT OF THIRTY COMMITTEE ACCOUNTS.

Unexpended balance, 31st December, 1905	Rs. 155,486·46
Estimated Income, 1906 (170,000,000 lb. at 30s. per 100 lb).	,, 510,000·00
	Rs. 665,486·46
Estimated Expenditure, 1906 (present amount allotted)	Rs. 540,000·00
Probable unexpended balance 31st December, 1906	Rs. 125,486·46
Estimated Income 1907, (175,000,000 at 20s. per 100 lb).	,, 350,000·00
	Rs. 475,486·46

EXPENDITURE, 1907.

America £20,000	Rs. 300,000	
Europe £10,000	,, 150,000	
Administration Contingencies	,, 10,000	Rs. 400,000·00

Kandy, 1st May, 1906.

CEYLON ASSOCIATION IN LONDON.—Submitted correspondence.

CEYLON TEA ON THE CONTINENT OF EUROPE.—Submitted correspondence with Mr. J. H. Renton. It was intimated that, as Mr. Renton had repeatedly pointed out that a vote for one year certain only, prevented good business houses being interested in Ceylon teas, the grant for 1907 would be the same as 1906.—Submitted pamphlet by Mr. J. J. Marcel *re* the Ceylon Tea Cess and the Continental Campaign.

CEYLON TEA IN AMERICA.—Submitted correspondence with Sir Stanley Bois and Mr. Walter Courtney. Read letter from Mr. Walter Courtney, in which he proposes using the P. A. stamp on all advertisements and all packet Ceylon teas in America. Read letter from Mr. Westland, objecting to the use of the P. A. stamp in the manner he has been contemplating. Resolved :—" That a cable be forwarded to Mr. Courtney requesting him to alter his intentions *re* the P. A. stamp."

Submitted correspondence with Mr. Wm. Mackenzie and laid on the table Mr. Mackenzie's accounts for 1905.

INDIAN TEA CESS COMMITTEE.—Submitted correspondence.—The Thirty Committee then adjourned.—EDGAR TURNER, *Secretary, " Thirty Committee."*

WORK DONE BY THE CEYLON "THIRTY COMMITTEE."

A RESUME.

In 1887 when the export of Ceylon tea had reached 13,834,057 lbs., of which 13,282,980 went to the United Kingdom, the Planters of Ceylon foresaw the time when the supply of tea for the world would exceed the demand, and at a General Meeting, held on the 15th October, 1887, Mr. H. K Rutherford brought forward the following motion :—

" That this Association recognising the importance and advantages to the Tea Industry of the Island by taking more vigorous and systematic steps to make Ceylon tea known throughout the world, strongly recommends the following project to the District Associations and to tea Planters for their support." "That Proprietors or Agents of Estates agree (on the condition that no less than 500 estates enrol their names) to pay into the Planters' Association of Ceylon every six months beginning from 1st January, 1888, 25 cents for every

1,000 lbs. of tea leaf plucked on their estate for the preceding six months, and that such monies so collected be used for the advertising and pushing of Ceylon tea in such manner as the Association may from time to time see fit, and in the first instance (should funds permit) that the Association do support the Glasgow, Melbourne and Brussels Exhibitions of 1888."

In his preamble he says:—"I come to ask you to 'invest' your money, and I use the word advisedly." The Resolution was seconded by Mr. Wm. Mackenzie and carried unanimously, and a second Resolution asking for the Chamber of Commerce to appoint a Committee to confer with the Committee of the Planters' Association was also carried. This was practically the origin of the present "Thirty Committee," though a Tea Syndicate Fund met with failure in 1886.

The Ceylon Tea Fund thus inaugurated supported the various Exhibitions all over the world and closed in 1894, but previous to that—in view of the Chicago Exhibition of 1892—it was felt that to enable Ceylon to make a good show, it was absolutely necessary to raise a large sum, so that tea should be well advertised, and this Resolution passed in September, 1892, unanimously:—

"That in view of the great importance not only to the Planting Industry but to the Colony generally, of Ceylon being adequately represented at the Chicago Exhibition, Government be requested in the first instance to levy a royalty upon tea at the Customs of 10 cents per 100 lbs. from 1st January, 1893, and until such date as shall be agreed upon between the Government and this Association, and in the meantime from 1st October next to continue the present Railway rates on tea and to get the sum so received, namely, the royalty on Tea and the difference between the old and new railway rates as a Planters' contribution towards the cost of the Ceylon Court at the Chicago Exhibition and the subsequent furthering of the tea enterprise in America, and further to supplement these contributions by equal amounts from the Revenue."

After the Chicago Exhibition had been paid for, the Planting community, seeing the necessity of continuing the advertising of tea in all parts of the world, the Ceylon Government agreed to continue the royalty or cess on all tea exported from the Island, and Ordinance 4 of 1894 was passed.

In 1894 Ceylon exported 85,376,322 lb. of tea:—

	lbs.
United Kingdom	76,434,117
Australia and New Zealand	7,218,838
Other British Colonies	184,017
British India	952,751
Other Countries (Asia)	178,084
Africa	57,087
United States of America	46,873
Canada	22,858
Europe, 11 Countries	281,697
(Germany:—170,813 lb.) Russia:— 43,152 lb.	85,376,322

The Ceylon Tea Fund had spent Rs. 140,000 during the seven years of its existence, during which time it had spent money in advertising Ceylon tea at Glasgow, Brussels, Melbourne, New Zealand, South Seas and Paris Exhibitions, and in Russia, Austria, Germany, America, and elsewhere, and the Tea Kiosk in Colombo,

The "Thirty Committee" has now been in existence eleven years.

The satisfactory increase of deliveries in Great Britain and the annually increasing amounts shipped to Australia showed that where Black Tea was drunk Ceylon would win its way on its own merits, and all advertising at

Exhibitions was stopped in Great Britain, and, with the exception of the Coolgardie Exhibition in Australia, as our geographical position helped us there with weekly boats running between Colombo and Australia.

Russia was a country we looked to, and the Tea Fund assisted Mr. Rogivue in 1890 by tea and funds to start a campaign there. Ceylon tea met with great opposition at first, owing partly to the Tea Trade of Russia being in the hands of a few very wealthy large Houses; but Mr. Rogivue's business grew, and the result was that when he had made a good business for himself, the Russian dealers in self-defence had to handle Ceylon Teas, and in 1898 Russian Tea buyers supported the Colombo market by their presence.

The necessity of any advertising of Ceylon Tea in Russia was done away with and the Trade left to itself; but should the Russian Government lower their very heavy duty on Tea to a reasonable amount, it may be necessary to again bring Ceylon Tea before the Russian public, as we have there a large population of Black Tea drinkers; but owing to the heavy cost of Tea the poorer classes are not able to purchase any large amount, as the consumption per head is but a little over 1 lb. against Great Britain's 6 lb. per head. The Duty in Russia is about 1/8½*d.* per lb. America is the country in which we have expended most money. The Chicago Exhibition cost a lot of money, but any good it might have done was not followed up until 1895, when Mr. Mackenzie started work there. He met with great opposition from the old established firms, but by adopting the system of supporting men who would push Ceylon Teas, he has seen the direct shipments of Ceylon Tea from Ceylon rise from 46,873 lb. in 1904 to 12,465,219 lb. in 1905.

How much is due to the money expended—it is impossible to say, in the words of Mr. A. M. White, the Chairman in 1894, at a General Meeting held in 14th April, when speaking of the Ceylon Tea Fund: "With a Fund of that nature it was impossible (demonstration was impossible) that they could say they had spent Rs. 5 here and had got back Rs. 5 or Rs. 10."

The same remark applies now; but when we consider that during the eleven years the "Thirty Committee" has been in existence some one hundred prominent Planters and Members of the Chamber of Commerce have given their time and money to carry on the work, it seems reasonable to suppose that a large amount of the exports to other countries is due to the advertising of these teas; and certainly no member has ever in any way attempted to benefit himself. In fact it is estimated that it cost the "Thirty Committee" members at least Rs. 10,000 a year to attend the Meetings for which they receive nothing.

Early in 1895 Mr. Mackenzie advised the Ceylon Planters to turn their attention to green teas if they wished to capture the American market. Little was done until 1898, when to encourage Planters the "Thirty Committee" gave a bonus of 10 cents per lb., and some 90,000 lb. were made from October, 1898, to the end of 1899; in 1900 some 600,000 lb. were made, and in 1901 1,800,000 lb.

1902	...	...	...	...	2,796,000 lb.
1903	...	...	...	...	3,647,000 ,,
1904	...	...	...	...	5,107,000 ,,
1905	...	...	...	...	3,169,000 ,,

Owing to a bonus given, the manufacture of Green Tea went ahead fast from 1900 to 1903, with the result that the end of 1903 and during 1904 saw a large stock of green teas in stock in America and Colombo, with the result that green tea fell to a very low figure. They have recovered since, and there is a steady trade in them for good desirable marks. The bonus was done away with at the end of 1904; but as Sir Stanley Bois pointed out in one of his communications from St. Louis (when he represented the Ceylon Government as Ceylon Commissioner),

Ceylon Green Tea had paved the way for an increased consumption of Black Teas as the Americans now know that there are other tea-producing countries besides China and Japan and—having tried our Greens—were trying the Black Teas; and he anticipated that once having drunk good black tea, they would not go back to Green Teas.

A new Commissioner has been appointed to America to live in the country. His appointment is for two years, and we hope to see some tangible results from his appointment before then.

Spasmodic attempts were made to advertise Ceylon Teas on the Continent of Europe, but until the Paris Exhibition of 1900 no sustained effort was made; but apart from Russia, no nation drank any appreciable quantity per head, and before we started the campaign we might have counted the cost, as it is a costly business trying to change the taste of a nation. It seems to be changing, though very slowly. The "Thirty Committee" have voted £10,000 to Mr. Renton for 1906, and have intimated to him that they hope to vote the same amount in 1907; and if by that time no appreciable increase is shown, it seems advisable to shut down expenditure.

It is, as mentioned before, impossible to prove the good done by advertising Ceylon tea in Foreign countries; but it is evident that the other tea-producing countries consider that the expansion of our Tea Trade to countries other than Great Britain is due to the work of the "Thirty Committee." The Indian tea producers, who had tried a voluntary subscription for some years to advertise their tea, approached the Indian Government on the question of a Tea Cess, and it came into force on 1st April, 1903.

Photo by H. F. Macmillan.

CACAO UNDER POLLARDED SHADE

The Cultivation of Cacao in Ceylon. I.

By Herbert Wright.

(Illustrated.)

It is a matter of common knowledge that the value of Ceylon cacao has, during the last few years, fallen considerably, and had it not been found that this product could be profitably cultivated as a permanent intercrop with Para and Castilloa rubber, the industry would in all probability have remained stationary. While the value of Ceylon cacao has recently shown a decline, that of many other countries has not done so, and judging from the numerous local applications regarding the varieties to be selected, the suitability of each kind in conjunction with rubber, and other matters, it appears necessary to consider our position and see what improvements are possible. In the Matale, Kurunegala, Dumbara and other districts the combined cultivation—cacao and rubber—is rapidly extending, and seems likely to prove a very remunerative one.

The output and value of cacao from Ceylon are obvious from a consideration of the following supplied by the Principal Collector of Customs, Colombo :—

Statement showing the quantity and value of Cacao exported from the Island of Ceylon during the years 1875 to 1905 :—

Year.	Quantity. Cwt.	qr.	lb.	Total Value. Rs.	Value per cwt. Rs.	cts.	Year.	Quantity. Cwt.	qr.	lb.	Total Value. Rs.	Value per cwt. Rs.	cts.
1875	No heading in Returns.												
1876	do						1891	20,015	2	19	1,200,940	60	00
1877	do						1892	19,176	3	2	1,342,373	70	00
1878	10	0	0	100	10	00	1893	29,775	3	3	2,121,524	71	25
1879	42	0	0	2,290	54	52	1894	22,791	3	11	1,139,592	50	00
1880	121	1	24	3,500	28	92	1895	27,522	3	20	1,128,440	41	00
1881	282	3	3	15,405	54	62	1896	33,890	3	5	1,101,450	32	50
1882	864	0	15	46,488	53	80	1897	35,121	0	24	1,299,484	37	00
1883	3,376	3	20	151,961	45	01	1898	38,098	3	21	1,676,353	44	00
1884	9,241	1	26	323,451	35	00	1899	42,527	2	26	1,875,047	44	00
1885	7,466	1	22	298,657	40	00	1900	33,696	3	12	1,651,146	49	00
1886	13,056	0	24	548,361	42	00	1901	47,471	0	0	2,321,331	48	89
1887	17,460	1	12	838,097	48	00	1902	61,476	0	0	2,537,764	41	27
1888	12,231	0	6	580,975	47	50	1903	59,098	0	0	2,248,145	38	04
1889	18,849	0	18	999,005	53	00	1904	67,355	0	0	2,448,354	36	34
1890	15,942	2	1	797,125	50	00	1905	69,431	0	0	2,433,556	35	04

The price of Rs. 70 per cwt. obtained in 1892, as against that of Rs. 35 per cwt. in 1905, takes us back to the most vital consideration, *i.e.*, the variety or quality of the cacao grown and exported during these periods. Since the ravages of the disease or diseases affecting the stems and pods first became prominent in Ceylon, there has been a tendency to replace the old Criollo or Caracas variety with the more prolific varieties of Forastero and Amelonado, in the belief that the latter was not as liable to the ravages of parasitic fungi. Now, however, the planters are beginning to realise that all varieties of cacao at present cultivated in Ceylon are liable to be affected by the same diseases, and when the latter appear in the fluted and high stems of the Forastero variety are very difficult to effectively excise. There has been, during the last two or three years, a distinct tendency to plant the old Caracas type in preference to the Forastero; the change of variety can be shown to be one of the factors responsible for the varying value placed upon the cacao exported from Ceylon.

During recent years the cultivation of shade trees for cacao has also undergone considerable change, and whereas the original plantations contained mixed species of forest types, or a preponderance of *Erythrina umbrosa*, they are now giving way to *Hevea brasiliensis*, *Erythrina lithosperma*, *Castilloa elastica* etc.; furthermore, the results of experiments indicate that the shade of *Erythrina lithosperma* need not be permanent throughout the whole year, but may be treated so as to form a shade of varying intensity according to the seasons.

In all the species mentioned above there is observable one important and common agreement, *i.e.*, they all change their foliage annually and return large quantities of organic matter, in the form of leaves, to the soil. Methods of manuring have also changed, to some extent, during the period under consideration, and the effect of the change in modes of cultivation can be shown to affect the quantity or quality of the article produced. The Ceylon methods of cultivation, particularly with regard to pruning, weeding, and manuring, are almost unique, and the differences observable in Surinam, Trinidad, Samoa, Cameroon, etc., provide interesting material for our consideration.

In Ceylon the methods of fermenting, washing, and curing are often quite different and sometimes quite in contradiction to those of other countries, and the effect of these processes on the quality of the article is only too fully recognised. In the opinion of many, the condition of the trees, whether they are free or suffering from disease, is of importance in determining quality and quantity.

It is therefore obvious that there are several factors which need to be considered in connection with the present and past condition of the cacao industry in Ceylon.

The factor which is perhaps more responsible for the range in value of the cured beans than any other is the variety of cacao selected, and with this we will deal.

(*To be continued.*)

COFFEE CULTIVATION IN BRAZIL.

The coffee planters of Southern India, wishing to know exactly how their industry stood in relation to that of Brazil, the Government of India in April, 1905, at the instance of the Government of Madras, sent a Despatch to the India Office asking for information regarding the Brazilian coffee industry. Very detailed questions were asked regarding labour and wages, cultivation, area, soil and forests; the system of cultivation; the type of trees; the raising of bye-products, shade on estates, abandonment of old and opening up of new estates, etc.; crops and the curing of coffee; diseases, and pests; finance, and cost of production; climate, and physical features of the coffee districts; transport and duties. This Despatch was transferred through the Foreign Office to the British Minister in Brazil, who distributed the lists of questions to the various Consuls, in order that they might make personal enquiry into the subject. The answers to these questions have now been collected and issued as a white paper by the India Office.

Transmitting the replies from the Consuls, the British Minister in Brazil, in his Despatch dated the 6th February, 1906, says:—

"The difficulty of obtaining trustworthy information of a statistical nature in this country is sufficiently recognised to render all explanation of the inability to furnish full and exhaustive reports from the various Consular districts unnecessary. The enormous area of the country, the difficulties of communication and the expense of travelling preclude the possibility of acquiring minute information which could only be obtained by a personal visit to the numerous coffee planters scattered throughout a large portion of Brazil, except by experts specially appointed for the purpose, without other occupations to attend to and with considerable funds at their disposal for travelling purposes."

RIO DE JANEIRO.

The British Consul-General at Rio de Janeiro writes of his district:—

"Coffee planting is the principal industry of Brazil and coffee is the principal article of export. The consumption of the world is estimated at 16,000,000 bags, the bulk of which is produced in Brazil which yields some 9,000,000 to 15,000,000 bags. The limited demand for the quantity produced caused a crisis in recent years owing to bumper crops and over-production. Since then there have been schemes to restrict production, but these have only taken effect in the State of Saõ Paulo, in which State alone can any official statistics on this subject be obtained.

Saõ Paulo is the principal coffee district.

LABOUR.—The conditions of labour are different in each locality. It may, however, be calculated that men earn about 2$ a day and women 1$, beside food. "Colonials" or those labourers established on the estate receive land and a certain number of trees in lieu of wages; others have an interest in the crop. The labour is chiefly Italian and Negro, and is bad and scarce. Immigration is required, but has been so badly treated that it is discouraged. Owing to extravagance the planters are mostly in difficulties and do not pay wages when due, or the men are fleeced by the truck system. It is possible for the labourers to live by the cultivation of their own plots. The work on the estate takes some nine months of the year.

Note.—1 melries=2*s.* 2·934*d.* formerly, now 1*s.* 5*d.* say Re. 1 cts. 6.

CULTIVATION.—It is only the principal coffee districts which are comprised in the newspaper reports; and there are large tracts of land unplanted and suitable for coffee, and these lands are likely to remain unplanted until the demand for coffee increases. It would probably not be practicable to obtain land for coffee-planting where restriction is in force, nor under the circumstances would it be likely to be profitable. There are extensive railways through the principal coffee districts, the rates vary but are high.

Old fazendas are abandoned and not cultivated, but coffee is picked when the trees happen to yield. When the trees no longer bear the plantation is abandoned, and as the land is privately owned it does not revert to Government, nor is it taxed. Coffee trees yield berries up to 30 years. After bumper crops the next crop or two is smaller. Land in Saõ Paulo in some districts produces 3 or 4 times as much as that in Rio de Janeiro. There does not seem to be any extension of planting, and that planting is to replace those trees that go out of bearing. There is not much planted that has yet to come into bearing. Trees begin to bear three years after planting. In Rio the land is hilly, and in Saõ Paulo undulating and flat, with a red soil. There is some heavy forest and much scrub, and the undergrowth is very thick, with creepers, thorns, and grass; heavy timber is found in the forests.

SYSTEM.—The cost of production and placing at local railway stations may be estimated at 4·300$ a bag of 60 kilos (or 132¼ lbs.).

There are two kinds of trees cultivated in Brazil, the "Bourbon" and "Criola."

The land is not manured, only weeded. No pruning, trees allowed to grow free. No artificial or other shade used. The branches of the "Bourbon" grow up, those of the "Criola" grow out and bend down.

The trees grow to about eight feet high and are planted two metres apart. A full grown tree is about one inch in diameter, one foot from the ground. When planting out one plant is put in each pit. Bye-crops are the

exception, and then generally consist of maize. No manure is used. No Government scientific help is given to planters. Abandoned plantations have become so from old age and want of cultivation, and are hopelessly gone. The only cultivation bestowed on coffee is keeping the trees free of weeds. Coffee trees ten years old are in their prime.

CROPS AND CURING.—A tree takes three years to come into bearing, and continues for 30 years. There are three blossomings a year—in August, September and October—and if these fail and there is rain there will probably be a fourth.

The crops are picked carelessly, the branches or twigs being stripped by running the hand down. Coffee is cured either by drying on a drying ground or is pulped. The yield in Saõ Paulo is calculated at 200 arobas (the aroba being 32⅓ lbs.) the alqueire of land. Full grown trees are affected to a certain extent after a heavy crop. Ants damage the trees.

FINANCIAL.—The system is by advances on crops and mortgage at 12 per cent. The present low priees leave a profit. The lower the exchange the more milreis are received as the price of coffee, so these crops represent gold. The higher the exchange the less profit is made, as expenses are paid in milreis and have not altered.

The financial condition of the majority of the estates is bad, and the general opinion as to the future of the industry is gloomy. No Government financial help is yet given. It is not likely that India can compete with Brazil in the production of coffee whilst the supply exceeds the demand.

CLIMATE AND PHYSICAL FEATURES.—Tropical, steamy, relaxing, but the climate depends on the attitude. No proper record of the rainfall in the different districts. The country is hilly, broken and overgrown.

TRANSPORT.—Extensive railroads run through coffee districts and connect with principal ports. F. O. B. expenses come to about 3$ per bag including price of sack. Sea freights to London about 50 shillings and 2½ per cent. primage. A ton consists of 17 bags.

DUTIES.—Export duties in Rio de Janeiro 8½ per cent., in Minas Geraes 9 per cent. Information obtained is often conflicting owing to the lack of reliable official returns, and it is difficult to ascertain the lowest price at which the production of coffee would leave a profit, as so much depends on the financial position of the planter and the condition to which the plantation may have been reduced by neglect or through lack of means. As a rule the planter has to calculate a profit after paying off the interest on borrowed capital.

PERNAMBUCO.

The report from Pernambuco states that the industry there is comparatively new and on a small scale. Labour is, however, very scarce. The rate of wages is from 0·800 to 1·000 for ten hours' labour. About six hands are employed to the acre, and they receive no supplements to their wages. They work, on an average, 265 days in the year for the planters, and can help themselves very little by subsidiary cultivation on their own account. In the district there are enormous uncultivated tracts suitable for the growing of coffee. These tracts are untouched owing to want of capital, communications, and transport. The land could be leased for 0·040 (about ½*d.*) per square metre. It is impossible, however, to say when communications will be improved. The soil of the district is good, consisting of black vegetable earth, clayey, loose, flat, loamy and retentive. No plantations have been abandoned, but no new plantations are being opened up. The country is rich in forest, both heavy timber and scrub, and the timber is often of great value. The undergrowth consists of dense grass.

It was only recently that planters in the district have taken to pruning their coffee, and not many of them do this. The ordinary height of the coffee tree is from 6 to 9 feet. The trees are never topped. They are grown unshaded, though when very young they are sheltered by the castor oil plants which are grown between the rows. This plant gives fairly dense shade, and the leaves later on form excellent manure. The coffee grown in the district is of the Arabian variety. The trees are planted, one in each pit, at intervals of 10 to 12 feet. Bye-products are cultivated between the rows of coffee trees when these are young. These by-products consist of mandioca, maize and castor oil. No artificial manure is used in the district, the only manure the plants get consisting of the coffee husks and decomposed vegetable matter left on the ground after weeding and cleaning. The condition of ten-year old trees is satisfactory, in spite of the fact that all the cultivation they receive consists of weeding. The trees come into bearing at the age of from 2 to 3 years.

There are usually three flushes of bloom, and blossoms and small green berries are often seen on the same tree. Only the ripe berries are picked. The yield is about 1,100 lbs. per acre. The trees after a heavy crop usually take two years to recover. The coffee is dried in the husk, stored for two or three months and then hulled. The only disease known in the district is the leaf-blight. This appears first as a small yellowish spot upon the leaves, which gradually get darker, till eventually the whole foliage is affected and the tree is killed.

The estates are managed by their owners, and being here fairly free from mortage, cultivation is still found to be profitable. The cost of production is from 14$000 to 17$500 per cwt. (1$000=17*d*.). The reason given for the fact that coffee cultivation is still found to pay, in spite of low prices, rising exchange and dear labour, is that, estates being managed by their owners, there is a saving in salaries to agents and middlemen, whilst efficient supervision is secured; freights from Brazil are low, the heavy Suez Canal dues are avoided, and land is more fertile in Brazil than in India. Nevertheless the outlook for the coffee industry in Brazil is not considered brilliant. In reply to the question as to what, in his opinion, was the outlook for South Indian coffee planters, the Consul, could hold out little hope for future prosperity. The cost of F. O. B. is given at 100 reis per bag of 75 kilos, and the freight to London as 30*s*. *plus* 5 per cent. per ton of 1,000 kilos. There is an export duty of 200 reis per 15 kilos.

SANTOS.

In his Report on the industry in Santos, His Majesty's Consul writing on the state of labour, the class of labour employed, and the wage rates obtaining says:—Brazilian planters are always short-handed. This is due to inability to pay the wages in many cases, consequent upon the crisis produced by low prices. Generally speaking, the great bulk of labour is Italian; probably 95 per cent. The wages average about Rs. 70$000 per year for taking care of 1,000 trees; one average family of say, five, man, woman, and three children, can take care of 5,000 trees per year=Rs. 350$000. Besides which they make for picking during the harvest say an average for the above-named family 20 alqueires (50 letros) per day for say 70 days=1,400 alqueires at 350 reis=Rs. 490,$000. They are allowed also to plant between the rows of coffee trees maize, beans, etc., and to keep pigs, goats, poultry, etc. In this way I calculate they would gain further about Rs. 500$000 per year or . . . . Rs. 350$000

	Rs. 350$000
	,, 490$000
	,, 500$000
Total ...	1,340$000

at 16*d*. exchange=£89-6-8.

This I estimate a family of five persons would make in a year. They save it almost entirely, as their food is practically raised by themselves on the land between the trees.

There are about 70 persons, labourers and dependents, employed to the 100 acres. The labourers work about 150 days for the planter and 150 on their own crops.

There is very little suitable coffee land left unclaimed, except in the far interior, where it is left untouched on account of unremunerative prices, the want of railways and the incident of the Government planting tax. All estates are owned by individuals. It is intended to extend the railways to the interior as soon as the growing of coffee becomes profitable. The estates in Santos were mostly opened from 10 to 12 years ago. The trees have recently come into full bearing and there has been much over-production, chiefly in the State of Saõ Paulo. Some of the estates show signs of exhaustion, owing to heavy crops and to lack of fertilisers. The virgin soil gives enormous crops for the first year, but as nothing is put back into the soil its powers become exhausted, The cultivation of bye-products, maize and beans between the trees tends to still more exhaust the ground. The average production has fallen off, and future crops promise to be smaller than former yields. Owing to the planting tax no extension is going on, and there is some abandonment of exhausted plantations. No new planting has taken place for three years. In Saõ Paulo the yield from the new vigorous lands has been very great. The best lands yield 80 to 100 cwt. of clean coffec per 1,000 trees. (700 trees go to the acre.)

The average yield for the whole country is, however, calculated to be not more than about 15 cwt. The ground is only weeded, no digging being done: neither is there any manuring. Pruning is done in a very primitive way. Topping is not practised. Coffee is grown unshaded. The trees are about 12 to 16 feet high, very thick and bushy. They are planted, three to a pit, at intervals of 4 yards. They are nearly all of the *Bourbon* and what is known as *café commun;* the former gives a large bean. Brazilian trees have all been imported from other coffee-producing countries, but have lost all their distinguishing characteristics. The trees come into bearing at from 3 to 4 years old, and are at their best between the ages of 10 and 15. When the coffee is being gathered the trees are stripped of everything, ripe and unripe. A great deal of ripe coffee falls on the ground and is gathered therefrom. The coffee is sometimes pulped, but is mostly sun-dried on brick platforms. There is no disease, the trees being too new, and pests are unknown. The estates, which are mainly owned by private individuals, are financed by Commission Agents in the port, who make loans for one year against which they are secured by mortage on the crop and also by mortage on the estate. The interest is high, 12 per cent. being the rule. The financial condition of most of the estates is unsound, 95 per cent. of them being mortaged to above their present value. The Government affords the planters no financial help. The opinion is expressed that the coffce planters of India cannot compete with Brazil, owing chiefly to the large yield of Saõ Paulo. There are good railways to the coffee districts, but owing to excessively high railway rates, the cost of transport is enormous. Exclusive of export duty, the cost of carriage from plantation to steamers averages about 10*s*. per cwt. The export duty on coffee from Santos is 11 per cent. *ad valorem*. There are heavy import duties exceeding sometimes 100 per cent. *ad valorem*. The freight to London is 30*s*. *plus* 5 per cent. per ton of 1,000 kilos.—*Madras Mail.*

SUGAR-MAKING IN SOUTH INDIA.

The attached letter should prove most interesting to everyone, be he native or European, engaged in agricultural work. In fifty days of sixteen hours each Mr. Krishna Iyengar, of Ooraghally Estate, Mysore, crushed by means of a small

12″×13″ mill, 700 tons of sugarcane, and produced 118 tons of jaggery which he sold at Rs. 120 per ton, equivalent to a total value of Rs. 14,160, and if he had had the additional plant for making white sugar direct from the cane, his product would have been 85 tons of white crystals, and 33 tons of molasses, which would have had a value of at least Rs. 200 and Rs. 40 per ton, respectively, in all Rs. 18,320, and produced without a single pound of fuel being purchased except that required to make a start with :—

Dear Sir,—As promised in my last letter I herewith send you a short account of the working of the cane mill supplied by you. The steamer which brought out the mill arrived at Madras on the 16th February, and after a delay of twenty days caused in landing and transhipping the mill arrived at my estate on the 8th March. By that time I had the oil engine, a 6½ B. H. P. one, fixed in position and in working order, and got ready the foundation for fixing the mill, besides having the boiling pans, pumps, water tanks, taps, etc., in fact the whole show, in order. So I lost no time in mounting the mill on the foundation and fixing it in position. The plan of the mill supplied by you beforehand enabled me to do this to a nicety without the help of any professional fitter. I started work on the 14th March, and closed it on the 2nd May crushing 25 acres of cane within that period working at the rate of 16 hours a day. I could have worked more hours, of course, but as I had no prior experience of oil engines, I had not provided for two water tanks for keeping the engine cylinder cool and had consequently to suspend work at the end of every eight hours, for by that time the water in the tank would very nearly get to the boiling point. Next season I shall provide against this.

Dr. Lehmann, the Agricultural Chemist in this State, kindly visited my estate and made experiments as regards the crushing capacity of the mill, the extraction, the quality of the juice and the jaggery produced. Your mill, I am glad, successfully stood the test, and as the last minute of the hour expired the last cane of the ton experimented upon came out of the mill crushed. The extent of my cane fields was 25 acres and contained 8,000 shoots to the acre, giving an average of 28 tons of cane to the acre.

A ton of cane yielded 3½ pansful of juice of 180 seers each, which on boiling yielded 14 maunds of 27 lb. of jaggery. I sold the jaggery at Rs. 120 per ton exclusive of commission, etc. My expenses for the conversion of cane to jaggery came up to 4 as. per maund or Rs. 100 per acre, including cost of establishment, cutting and carting of cane to mill, oil, fuel, etc. I did not use the pith as fuel but used nearly 200 tons of good firewood. The cost of fuel could be cut short by using the pith, and I wish you will kindly suggest the use of some machinery for evaporating the juice using the pith as fuel.

The news had spread far and wide that a cane crushing mill driven by an engine was for the first time to be brought to Ooraghally and worked there, so on the day the machinery actually arrived and was transhipped from Bidadi Railway Station, quite a crowd of people followed the carts carrying the machinery all the way from Bidadi to my estate, and very good naturedly rendered me not a little assistance. The noise caused by the lamp used for heating the vaporiser created not a little surprise, as no steam issued out as when a steam engine blows out, and many questioned me why the engine did not whistle. Most of them studied intently the different parts of the engine and the mill and their working.

Every day brought hundreds of persons from all the country round, and many came from distances of 30 and 40 miles. The ryots were not at all apathetic in this matter, as it is usual with them to be in other matters. More than the Sudras I found the Pariahs were eager to learn all about the machine. Some whom

I employed to help me very intelligently and readily picked up all about cleaning, oiling, starting and stopping the engine. I have four of them now with me well trained. Two of the goldsmith caste volunteered to learn the work. They were given an opportunity to do so, and have learned all about the engine and the mill. So, at the end of the season, I used to leave the machinery entirely in their charge.

Sometime ago when you mentioned in the *Madras Mail* that I made 400 maunds of jaggery per acre, and that I sold it last year at Rs. 2-8-0 a maund, Mr. B. K. Garudachar, of Bangalore, contradicted the statement and said that it was not possible to get 400 maunds of jaggery per acre on large plots of 30 or 40 acres, and that if I at all had sold my jaggery at Rs. 2-8-0 it must have been to some of my tenants during a festival. Now I have milled a plot of 25 acres, and on this I have managed to make very nearly 400 maunds, although the canes had dried up to some extent and had also deteriorated in sugar value by being over-ripe. This yield under these adverse conditions is mainly due to the higher extraction your mill gave over the ordinary cattle mill.

I have a quarter acre plot for experimental purposes, and on this plot and with the cattle mill I used to make 100 maunds when the canes were quite ripe. This year on the same plot I have got 120 maunds, using your power mill, although the canes were over-ripe.

As regards the price at which I sold my jaggery last year I wish to tell you that Mr. B. K. Garudachar himself bought two-thirds of my crop at Rs. 2 per maund, and after incurring the expense of carting from my estate to Bangalore, warehousing and other expenses, and loss in weight due to keeping for two months, made a good profit, and moreover asked me to sell the remaining third also to him. But as I had sold the jaggery at Rs. 2-8-0 to a merchant prior to his request I could not oblige him.

In conclusion I may mention that the loss I have sustained by the late arrival of the mill has been more than compensated by the satisfactory way in which the mill worked and the higher extraction it gave, the considerable time and labour it saved, not to speak of the advantage I derived by being able thereby to convert within a short time a large extent of cane into jaggery, and place the same within the time stipulated in the hands of the merchants with whom I had contracted to supply a large quantity.

—*Madras Mail.* N. K. IYENGAR.

THE CULTIVATION OF GINGER.

Here we have another article which is in universal demand, and for which good prices can be obtained. Ginger grows to perfection in any suitable soil on all the coastal lands of the State. There is no more difficulty in growing ginger than in growing arrowroot, peanuts, castor oil, or sunflowers. There is, to be sure, a considerable amount of light labour required to prepare the rhizomes for market, but the preparation is so easy that it can be done by girls and boys.

Two essential requirements for the growth of the plant are—sunshine and moisture. These conditions are found in Eastern Queensland. The process of planting differs little from potato-planting. "Fingers," containing an eye or embryo, are planted in holes or trenches a few inches beneath the surface, about one foot apart. All that is needed is to keep the ground clean, and the young plants well watered, the soil being, of course, well drained, because stagnant water gives rise to black rot, and in this condition the root fills with water, swells, has a bad smell, and is then attacked by insects and worms.

The very highest quality of ginger is produced on deep, rich, black scrub or virgin forest soil. It can be grown year after year on the same ground, and when the soil becomes too poor to grow "white ginger" an inferior variety—the blue—will yield good crops.

More depends on the curing of the ginger than on the soil, and regularly shaped "hands," as the roots are called, command the highest price in the market.

Planted in October, it is ready for digging in July or August. When the stalk withers it is ready for harvesting. In digging out the roots they must be care fully turned out with a fork without bruising or breaking the hands. These hands are divested of fibrous roots and of all adhering soil, and this must be done as soon as they are dug, for, if allowed to dry with soil, &c., adhering to them, the ginger will never be white. After cleaning, the roots are thrown at once into water, and are ready for peeling.

The peeling is an art easily learned. As the oil cells on which the aroma of ginger depends are close to the surface of the root, the peel must be very thinly taken off with a narrow-bladed knife. As fast as the roots are peeled they are thrown into water and washed. A very little water will serve to wash a great deal of ginger. The roots remain in the water all night. Lime-juice in the water will give a whiter root. By using boiling water the peel comes off easily, and what is known as black ginger commercially is produced.

After washing, the roots are dried in the sun on mats or boards laid on the ground. They are exposed at sunrise and turned over at midday. At sunset they are taken in or carefully covered, as rain or dew causes mildew. It takes about six or eight days to thoroughly dry them. When dry they are graded or sorted. The highest grades are large-sized hands of light, uniform colour, free from evidence of mildew. This grade is very brittle and cracks easily, but they must not be broken, or the value is depreciated. There are generally four or five grades, that which is shrivelled and small being in the lowest. The dark varieties form another; the heavy, tough, and flinty, a third. These four are finally assorted by placing hands which are small but of good texture and colour as one grade; the larger-sized, well-bleached hands are placed in the highest grades. The finest hands will range in weight from 4 to 8 oz. Ginger is always packed in barrels for shipment.

As to yield and profit of the ginger crop, these depend, like all other soil products, on soil, rainfall, sunshine, planting, care, and curing. An average yield can be estimated at from 1,000 to 1,500 lb. dried ginger per acre; 2,000 lb. have often been obtained.

Prices for ginger vary. As much as £10 per cwt. is often paid in the London market for the very highest class of white ginger, but the usual market price to-day averages all round from £2 2s. to £3 10s. per cwt. for Jamaica ginger, the same for Cochin, and 18s. to 18s 6d. per cwt. for Japanese.

Now in all this there does not exist a single reason why ginger should not be grown by any farmer who has suitable soil in a suitable locality, and especially by those who, like the Hatton Vale farmer, are blessed with a family of fourteen boys and girls. Think what a lot of ginger they could prepare of an evening sitting round the fire on an August night, in the same way as forty-five years ago the farmers' wives and children and the farm hands used to prepare arrowroot, grating the roots into tubs and buckets on graters made of kerosene tins. Arrowroot was worth form 1s. 6d. to 2s. per lb., and it paid to prepare it by hand. How much better would it pay to prepare ginger, so easily grown, so prolific, so easily cured, due care being exercised, and for which, in the United States alone, there is an annual demand for over 3,000,000 lb., leaving Great Britain and other European countries out of calculation.—*Queensland Agricultural Journal*, April, 1906.

PLANT SANITATION.

Entomological Notes.

BY E. ERNEST GREEN, *Government Entomologist.*

(ILLUSTRATED.)

Amongst the various species of 'Nettle Grubs' that frequent the tea-bush the larva of *Thosea cervina* seldom attracts much attention in Ceylon, though--under the name of the "Assam Nettle Grub" it is recognised as an important tea-pest in parts of India (*vide* "Pests and Blight of the Tea Plant," 2nd Edition, p. 203). I did not include this species in my account of the caterpillars affecting the tea plant in Ceylon (R. B. G. Circular, Ser. I, No. 19) as it had not then qualified for a place amongst serious tea pests; and it was not until May of the present year that I received notice of widespread damage by this caterpillar. Specimens were then received from the Haputale district with the report that they were present in millions and were attacking the best flushing tea on the estate.

This particular nettle grub is fully twice the size of either *Thosea cervina* or *Thosea recta* (the Morawak-korle nettle grub). It is of the usual form and is amply provided with stinging hairs. It is of an apple green colour with an irregular saddle-shaped patch on the middle of the back which varies considerably in both size and colour. In some individuals the patch may be bright orange red; in others, of a brilliant violet tint; or it may be variegated with red and white. The younger individuals are usually the more brightly coloured. Specimens of all ages were present at the same time. Some were full grown and commenced to pupate on the 16th of May, others are still feeding. The moths commenced to hatch out a fortnight after pupation. The cocoon is dark brown and smooth and has been likened to a tea seed. Watt and Mann state that--in India--the cocoon is constructed underground. In my breeding cases many of the cocoons were attached to the leaves of the plant. To distinguish it from its allies the species might be called the 'saddle-backed nettle grub.'

As with all serious caterpillar pests of the tea plant, the most effective way to check the attack is to prune heavily and burn the prunings together with all fallen leaves and rubbish from below the bushes. But where--owing to the condition of the bushes--this treatment is considered too heroic, nothing remains but to collect the caterpillars and cocoons by hand as thoroughly as possible.

I have another report of an attack of Morawak-korle 'Nettle Grub' (*Thosea recta*) from the Kelani Valley. In this instance the caterpillars first appeared upon the Albizzia trees and from thence spread on to the tea.

I have received from the Haldummulla district a hitherto unrecorded tea-pest. It is one of the 'Mealy bugs' characterized by a fringe of very long waxy processes which give the insect a star-like appearance. My correspondent reports that "four or five tea bushes near the edge of the jungle are covered with the insects." I have previously taken this species in lower Haputale and Koslanda upon a species of wild Jasmine. It will be described in my Monograph of the Ceylon Coccidae under the name of *Phenacoccus ornatus*. It is probable that these tea bushes have been infected from a Jasmine plant in the neighbouring jungle.

During the latter half of May I made a tour through the coconut districts of Batticaloa to study the pests of the Coconut palm. The following is a list, in the order of their importance, of the insect enemies observed during my visit:—

Black-headed Caterpillar (*Nephantis serinopa*, Meyer.)
Red Weevil (*Rhynchophorus signaticollis*, Chevr.)
Black Beetle (*Oryctes rhinoceros*, L.)
Scurfy Scale-bug (*Aspidiotus destructor*, Sign.)
White scale (*Hemichionaspis minor*, Mask.)

I have given the 'black-headed caterpillar' the first place, because, though not so widely distributed as are the two species of beetle, the attack was very acute at the time of my visit. On two adjoining estates—to the north of Batticaloa town—every single coconut tree was more or less involved, and in the worst parts the fronds were completely skeletonized (see Plate A.). On one of these estates the moths were on the wing and were resting on the trees in thousands. They seem to prefer the older drooping fronds. It was remarkable that no moths could be found on the adjoining estate, though the caterpillar was present there in full force. It is evident, from this, that the broods are not synchronous, but appear irregularly. Lamp traps were being employed at night with considerable success. Two kinds of lamps were in use: one—a powerful acetylene burner projecting from the centre of a large tray containing water with a film of kerosene, and others—small kerosene lamps supported on a brick in the middle of a basin of kerosene and water. The more powerful light naturally attracted the larger number of moths, but the smaller lamps could be distributed more evenly through the fields, and the sum total of their catch was considerably greater than that of the single acetylene lamp. The result of one night's work was 169 moths in the tray of the acetylene lamp, and from 20 to 60 to each of the smaller oil lamps. The size of the tray containing the water and kerosene would seem to be a more important factor than the brightness of the lamp. If of insufficient diameter many of the moths circling round the light escape capture. For practical work a tray of not less than 30 inches diameter should be employed. I am convinced that a large number of small kerosene lamps distributed through the infested area will be more effective than a few more powerful lights.

A certain amount of discredit has been thrown upon the use of lamp traps, it being stated that the resulting catch consists principally of spent males and females that have already deposited their eggs. This is undoubtedly the case with some insects; but it varies with individual species. With regard to moths of this coconut caterpillar, I was able to satisfy myself fully that fertile females were attracted and captured in large numbers. Disection of the captured females showed the ovaries to be densely packed with eggs in different stages of development. The result of such disection suggested that the eggs are not all laid at one time, but in many small batches. Later experiments with living moths proved that normal batches consisted of from 12 to 20 eggs. The eggs while still in the body of the female are of a greenish tint; but after deposition they are pinkish. It was only after a long search that the natural habitat of the eggs was discovered. They are deposited amongst the frass and debris of the larval galleries, and are more or less masked by a covering of down from the body of the parent moth. The discovery of the position of the eggs is of importance, as it shows that a removal of affected fronds or parts of fronds—besides resulting in the destruction of the existing larvae and pupae—will get rid of a very large number of eggs that would have given rise to the succeeding generation. There must, however, be other localities for the

eggs, as it is clear that, on the first invasion, there would be no larval galleries in which to oviposit. It is possible that the fibrous matter at the base of the young fronds may form a nidus for the eggs. Palmyrah palms suffer equally with the coconut. There are many stunted palmyrahs in the neighbouring scrub, and these are thickly infested by the caterpillars. Such useless palms should be destroyed as they will harbour the pest after it has been eradicated from the coconut estates. It is intended to issue a circular given the fullest particulars about this pest and the best means of combating it.

The Red Weevil and Black Beetle may be considered together as, in Ceylon, they appear to be very largely interdependent upon each other. There seem to be good grounds for believing that the reduction of the Black Coconut Beetle results in a corresponding diminution in the numbers of the Red Weevil. The smell of the fermenting sap that exudes from the holes excavated by the former attracts the latter and affords an easy entrance for it. On the other hand, the decayed stems of palms that have been killed by the Red Weevil form a favourite breeding place for the Black Beetle. The importance of the destruction of such breeding places is not sufficiently realized. Cases have occurred where the estates have been fenced with dead palm stems within which the beetles were breeding in thousands. It will be necessary when the Pest Ordinance comes into force, to insist upon the destruction (preferably by fire) of all dead palms and decaying rubbish.

To the south of Batticaloa several abandoned coconut estates were observed, upon which hundreds of dead palm stems are left standing. The remaining trees are dying fast, probably being killed out by beetle (see Plate B). The dead stems must be breeding enormous numbers of the beetles. Government should be petitioned to take over these places—under the Waste Land Ordinance—and put them into a sanitary condition. At present they are a standing menace to the neighbouring estates.

Of the two species of scale bugs (*Coccidae*) frequenting the Coconut Palm the 'scurfy scale' (*Aspidiotus destructor*) is the more serious. It occurs in large colonies covering the undersurface of the fronds. Such fronds may be recognized by their sickly yellow colour, and should be cut off and destroyed. This species is reported to be extremely destructive to Coconut Palms in the Laccadive Islands. The other species (*Hemichionaspis minor*) is of little importance and is unlikely to cause any appreciable injury.

Mosquitoes are a serious inconvenience in the Batticaloa district. I have never encountered Anopheles mosquitoes in such enormous numbers as during my two visits to Batticaloa. Each morning the outside of my mosquito net was thickly sprinkled with disappointed applicants for my blood. *Anopheles rossi* was the principal species, and is probably responsible for the occasional outbreaks of malarial fever. In Batticaloa town itself, the sole breeding place appears to be the margins of the brackish lake. Any remedial measures will be very difficult in such situations. On the estates I found the larvae abundant in the small water holes scattered throughout the properties and used for watering the young coconut plants. On some estates earthenware chatties are sunk at the base of the young palms and frequently replenished with water. These also afford breeding places for various mosquitoes. The destruction of the larvae in the water holes and chatties would be comparatively simple. A bunch of rags, fastened on a stick, should be soaked in kerosene and stirred into the holes, leaving the merest film of oil on the surface. This should be repeated at intervals of three or four days. The small amount of oil on the water would have no prejudicial effect upon the plants to which it was applied.

Plate A. COCONUT PALM, WITH FRONDS SKELETONIZED BY CATERPILLAR OF *Nephantis Serinopa.*

Plate B. ABANDONED COCONUT ESTATE, WITH NUMEROUS DEAD TREES IN WHICH COCONUT BEETLES ARE BREEDING.

From Photographs by R. P. Doudney.

The small biting fly (*Phlebotomus sp.*)—locally known as 'Sand Fly'—is sometimes very troublesome in bungalows, especially in bathrooms and lavatories. Though of very minute size, its bite is quite as painful as that of the largest mosquito. To clear these pests from a room, place a chatty of burning charcoal on the floor, throw on a handful of powdered sulphur, and close the doors (and every possible aperture) for an hour or two. If this treatment is employed in a dwelling room, all brass and metal ornaments (which would be tarnished by the sulphur fumes) should be removed.

Though not strictly appertaining to Entomology, I think that it is within my province to draw attention to what I consider an alarming increase in the numbers of the common European sparrow in parts of the Island. On a recent journey by coach from Bandarawella to Badulla I noticed quite large flocks of these birds. They seem to have increased very rapidly during the last few years. If nothing is done now to check their further increase, there will be serious trouble later, when they begin to devastate the rice fields. I am of opinion that organised efforts should be made at once to keep them in check or even to exterminate them. The sparrow has proved an unmitigated curse in every country to which it has been introduced. Their nests should be ruthlessly destroyed on every opportunity. This should be no difficult task as they almost invariably make their nests in easily accessible places in buildings. The thatch of a native house is a very favourite situation.

Termes Gestroi: The Hevea Rubber Termite.

By E. Ernest Green.

"On the Life History of *Termes gestroi*, Wasm. The Hevea Rubber Termite." E. P. Stebbing—(*The Indian Forester*, Vol. XXXII, No. 3.)

The author quotes reports from various observers in the Malay Archipelago and draws his own deductions therefrom. One of these deductions is of such a startling nature that it should receive careful investigation and indisputable corroboration before acceptance. On page 111 appears the following paragraph :—

"It would appear that *Termes gestroi* attacks the tree for the purpose of obtaining the rubber from it, for, on applying pressure to the bodies of the termites, it was found that the majority of them were full of fresh latex. They apparently collect and store the rubber, masses of rubber being found as a rule in the nests, which are usually situated at the crown of the root. From one of these nests, situated at the base of a three-foot girth tree, as much as 2 lbs. of rubber was collected."

This seems to me a most improbable explanation of the facts, though, of course, there is nothing inherently impossible in it. Being—myself—equally (with the author of the paper in question) unacquainted with this particular termite in a state of nature, it is with diffidence that I venture to put forward what appears to me a more probable interpretation of the observed conditions, namely, that the accumulations of rubber found occasionally in the nests is the result either of a natural flow of latex following upon the wounding of the tree by the termites, or of the abnormal exudation due to a previously diseased condition of the tree. It would be interesting to know whether the supposed latex found in the bodies of the living insects was tested and proved to be rubber latex. It seems possible that this statement may result from an error of observation. It is well known that the 'soldiers' (the class most in evidence when a nest is disturbed) of all termites, upon whatever they may have been feeding, secrete a viscid milky fluid which they eject from their mouths upon the least provocation. This fluid appears to have

some offensive properties to other insects and is certainly a protective device. When ejected on to the human skin it produces a reddish brown stain that defies soap and water for many days. I would suggest the following additions to Mr. Stebbing's 'points requiring further observations and elucidations.'

(*a*) What proportion of the nests contain accumulations of rubber?

(*b*) What is the condition of such rubber? Does it appear to have coagulated in mass (such as would occur from a natural flow), or to have been built up—bit by bit,—as would be expected if resulting from the individual collections of numerous insects?

(*c*) Does the milky fluid found in the bodies of the insects have the same reaction as true rubber?

Mycological Notes.

By T. Petch, *Government Mycologist.*

The fungi hitherto recorded as parasitic on *Castilloa elastica* are not very numerous, and in most cases are negligible from an economic point of view. The most important is *Corticium javanicum*, Zimm., which grows on the branches and apparently kills them. It is a common fungus in Java and attacks all kinds of trees, covering the stems and branches with a flesh-coloured or yellow sheet of fungus tissue, and producing the open wounds commonly known as "canker." Up to the present there is no record of its occurrence in Ceylon.

Other Javanese fungi on Castilloa include *Antennaria castilloae*, Zimm., which forms a black covering on the leaves attacked by scale insects; *Aschersonia sclerotioides*, Henn., which probably is not parasitic on the leaf, but on a scale insect; and *Diplopeltis Zimmermanniana*, Henn., also on leaves. These apparently do practically no damage to the tree.

With the extension of *Castilloa* cultivation the number of parasitic fungi will no doubt increase, though it is rather remarkable that recent accounts of *Castilloa* plantations, while referring to injurious insects, make no mention of fungi. Already three can be added to the list from Ceylon.

The first of these is a root fungus which attacks all cultivated plants from Caravonica cotton to *Hevea*. It covers the root with a brown felt which cements to itself soil and stones and forms a mass sometimes double the original diameter of the root. When far advanced this covering acquires a black, uniform, external layer. It passes from one root to another when they are in contact, but apparently it does not spread through the soil unless there is a continuous path of living or dead wood. Many instances have been recorded of its occurrence on various plants, but in every case the disease seems to have been got rid of by removing the affected tree and liming the soil. The fructification of this fungus has not yet been found or cultivated; apparently it occurs in other countries on cacao and coffee, etc., and the same difficulty is experienced in determining to what species the mycelium belongs.

The second fungus is, according to our present knowledge, a wound parasite only. It occurred on the Experiment Station, Peradeniya, where it attacked two trees which had been injured by fires. A strip of bark about three feet long and four inches broad on each tree was converted into a black, soft rotting mass containing fungi and insects of various kinds. The most abundant species, and the only one found near the sound bark, was a *Botryodiplodia* which has been named *Botryodiplodia elasticæ*. The mycelium of this extended into the wood and discoloured it, and the black coloration of the decaying mass was due to the mycelium and fructi-

fication of the fungus. All the diseased tissue on one tree was cut away, and the wound healed in a few months. The diseased bark was stripped off the other, but no attempt was made to cut out all the affected parts; indeed, even this treatment was contrary to instructions, as we wished to ascertain what effect the fungus would have on the tree if unchecked. During the ensuing dry weather a healthy callus was formed round the wound, but with a renewal of the rains, the fungus recommenced active growth and spread in all directions, almost completely destroying all the bark. At the same time, white ants attacked the diseased wood and reduced the tree to a narrow stick about an inch in diameter with a strip of sound bark on one side.

This fungus has not been found elsewhere on *Castilloa*, but it attacks and kills young *Hevea brasiliensis*, especially stumps. It has also been found saprophytic on dead *Hevea*. Its effect on young *Hevea* will be dealt with later.

A third fungus was found on a specimen submitted for examination a short time ago. The affected trees show an open wound at the collar, extending up the stem in a long triangular patch and at the same time spreading more extensively on the roots. It is similar to the "foot rot" of orange trees, and, like that disease, is caused by a species of *Fusarium*. The fungus appears through small cracks in the apparently sound bark in the form of white tufts which at first sight may be mistaken for drops of coagulated latex. Diseases of this class are favoured by bad drainage or excessive shade, anything, in fact, which causes an abundance of moisture at the foot of the tree. In one instance, the affected trees are in an area which cannot be properly drained, and in another, though the drainage is good, the trees have made such remarkable growth that there is probably too much shade. It has been recommended that the measures adopted against "foot rot" in orange trees should be tried in this case, but it is as yet too early to say whether they are successful. The earth is removed from about the tree so as to expose the collar and part of the roots. The diseased tissue is then cut away, and the wood painted with a mixture of crude carbolic acid and water in equal parts. All the wood and bark removed must be burnt. The hole should not be filled up until the tree has recovered, and, if possible, the shade should be thinned out so that the sun may reach the affected parts.

In other investigations, two interesting results have recently been obtained by cultivations at Peradeniya. The white root rot of tea, which has hitherto been confused with *Rosellinia*, and which seems never to produce any fructification in the field, has in four cases developed a sporophore which proves it to be a species of *Polyporus*, one which, judging from a brief visit to Hakgala, is common in the jungle on dead wood. The other result concerns the "Thread Blight" dealt with in the *Tropical Agriculturist* for April, 1906; this, at least on nutmeg trees at Peradeniya, is the mycelium of a small stemless agaric (mushroom), a species of *Crepidotus*, which is only fully developed on twigs etc. after they have fallen and commenced to decay.

HORTICULTURE.

Market Gardening in Nuwara Eliya.

By C. W. Bartholomeusz.

Before entering into the immediate subject which I have attempted to deal with, I propose giving a short sketch of the history of market gardening in Nuwara Eliya. I need not mention that the materials from which I have had an opportunity of gathering some facts for this purpose have been few, and that I had more or less to depend on isolated passages in books and district manuals touching on Nuwara Eliya in general, and on what I have heard.

Nuwara Eliya, as far as I can gather, owes the introduction of the English vegetables now grown, to the enterprise of Sir Samuel Baker, the great traveller and sportsman whose books "Eight Years in Ceylon," and "The Rifle and Hound in Ceylon," we are more or less familiar with. In the year 1848, the late Sir Samuel Baker and his brother resolved to establish a real English farm and village on the estate which still bears their name, now better known as Mahagastota estate—big tree estate—evidently from the large blue gum trees planted there. It is hard now to realise the difficulties and disappointments Sir Samuel had to face and conquer. We read in his "Eight Years in Ceylon," that when with infinite trouble the soil had been prepared, the first crop of oats was enjoyed by elk and wild pig, who held grand midnight festivals. In like manner we read that the first crop of potatoes was entirely consumed by black grubs, a pest which still does an immense amount of harm in our gardens. However, patience and perseverance were rewarded in due time, and after careful treatment and generous manuring the soil was found fertile enough for all purposes, and we read of his obtaining four crops of potatoes in the year. From this time we can safely assume that English vegetables were grown more or less in Nuwara Eliya, probably at first for the use of the few settlers, followers of Sir Samuel Baker, and the other pioneers of Nuwara Eliya, and as time went on, for supplying the other towns.

The virgin soil of the new clearing seems to have been specially adapted for the growth of potatoes, and the early settlers always speak of the enormous crops of this tuber which were a source of income to a great many of them, they carrying on a trade with Colombo and Kandy. Tubers each weighing from 1½ to 2 lb. were not uncommon, and the large crops gathered allowed of an easy profit on the outlay. But one mistake seems to have been made, and that was that the potato crop was for a long time the only crop put on to lands, and, as a natural result, as soon as the soil was exhausted of its potash and other chemical elements suitable for its growth, the potato crop failed and Nuwara Eliya had a potato blight which started early in the eighties. I do not mean to say that potatoes have not been grown since, but the crops, if successful, are poor and not to be compared with the crops obtained in the past. The last few years have seen a few good crops, and more may be expected with careful manuring and good management.

On the failure of the growth of potatoes greater attention was paid to the other English vegetables; cabbages, cauliflower and knolkohl were largely planted. Here, too, it should be noted that carrots, turnips, beet, and other root crops were not grown so much at the start as they are at present. The gardens replete with the chemical substances favourable for the growth of cabbages, etc., which were not touched by the repeated crops of potatoes taken off them gave good crops, and the cabbages grown were enormous. It made one's heart rejoice to

see the giant drum head cabbages in those days which could in point of size and weight easily compare with, or even outclass some of Messrs. Sutton & Company's "Giant Drum-head" prize cabbages, or Messrs. Carter's Mammoth Beef Heart cabbages. It was not unusual then to have six, seven or eight continued and repeated crops of cabbages or cauliflowers from off the same plot.

Within the last four years the failure of the successful growth of cabbages and cauliflowers in the gardens in the town, for causes to be dealt with later on, has in turn led to a greater attention being paid to the growth of root crops such as carrots, beetroots, parsnips, etc., and has seen the introduction of the more useful English garden herbs which grow to some perfection; the gardens in the town now mostly grow these crops.

Market gardening in Nuwara Eliya has greatly developed, and the supply to-day is inadequate to meet the demand. The great demand there is for fresh English vegetables and the necessity there is, therefore, that a better method of cultivation should be adopted, and that our gardens should keep pace with the horticultural progress of the day, can be gathered from the fact that Messrs. Paul Soris & Company, who supply the German line of steamers calling at Colombo send monthly on this order alone an average of 3,000 cabbages, 20 to 30 thousand carrots, 15 thousand turnips, beside large quantities of other vegetables.

In attempting therefore to lay before this meeting a few of the difficulties to be met with in market gardening at present in Nuwara Eliya. with the causes of these difficulties and the remedies which could be suggested, I only hope that the subject will be of interest to those who not only gain a living, but supply a great want, and at the same time induce others, whose greater experience and more practical knowledge of the subject better qualifies them, to express their opinions and suggestions thereon.

For the last five or six years the growth of cabbages, cauliflower and knolkhol has met with no success, and at present it is hard to get a single cabbage to grow sucessfully in any of the gardens in the town. In fact, it is very hard to get a crop to come to any perfection *out of seed*, and this difficulty is partly avoided by many of our gardeners by getting sprouts (called "*Rikili*") from healthy cabbages from Ragalla and Kandapolla, which come to some perfection in carefully prepared soils. Local suppliers have been forced to get their cabbages from Palugama, (Wilson Plains), Kandapolla and Ragalla, where the cabbage still seems to thrive. This must be attributed largely to a soil exhausted in sulphates, phosphates and potash. A cabbage according to Sutton wants a soil containing 8 per cent. sulphuric acid, 16 per cent. of phosphoric acid, 4 per cent. of soda, 48 per cent. of potash, and 15 per cent of lime, and it is evident that we cannot expect to grow a cabbage on a soil which is destitute of these ingredients, to say nothing of others. The repeated planting of cabbages in the present gardens with no change in the crop had undoubtedly exhausted the soil of these ingredients, and it is only after great care in the selection of soils, manure, and probably after the ground has been treated with a rotation of crops on some scientific plan that one can expect to grow a cabbage with success.

In dealing with this difficulty it ought to be borne in mind that to make our gardening successful great attention should be paid to *the rotation or alternation of crops*, for this will enable one not only to get the largest possible production, but the highest possible quality of every kind of crop. We have noticed the evil effects of our gardeners in Nuwara Eliya limiting their first crops mostly to the potato, and we have then seen how the repeated planting of cabbages and cauliflower without any alternate crop of any other kind on the same plot of ground, one crop following the other for a long series of years, ended in a complete

exhaustion of the soil. naturally exhausted of its sulphates phosphates, lime and potash. There are soils which will take a long time to be exhausted, and will not cease to yield a good return, but such soils are an exception, and the present garden soil of Nuwara Eliya is too exhausted to give any return without careful preparation. The science of the rotation of crops or "the science," as it has been defined,—"of the ordering of a succession of crops in such a manner that the crops will tax the soil for mineral elements in a different manner," known to the horticultural world ages ago," seems to have been sadly neglected by our market gardeners in Nuwara Eliya. The science is based one may say on the trite maxim "nature abhors a waste," or in other words is founded on the dogma of the economy of nature.

Two principles underlie it, which, if rightly understood and kept in mind, will appeal to any lay mind—(1) It must be remembered that each plant seeks its own food and assimilates, from the ground through its roots, only such chemicals and other food stuffs as are absolutely required for its welfare. (2) On the other hand it sends out and disperses from its system what is considered as waste matter to it, but which is food for and to some other plant. Bearing this in mind one sees the necessity of changing the crops on the same plot, so that when one crop has taxed the soil in one class of food-stuffs a different crop takes its place which requires quite different foodstuffs.

I shall not encumber you with technical details of the food stuffs suitable to most of the garden vegetables. A text-book on the subject will supply any one interested with the different requirements of our common garden vegetables, and one will also find that with all that has been said and written on the rotation of crops, there is yet a great deal to be learnt by individual experiments, careful management, and observation,' and that each gardener must learn by experience to treat his plot of ground in the best manner possible. But I do not think it out of place to summarise a few practical hints for your guidance, which, I hope, will be of use to some of you.

(1.) A good rotation will include both chemical and mechanical differences, and place tap roots in a course between surface roots, as for example, after cabbages and cauliflower it will be found that a crop of carrots and parsnips will thrive very well, simply because their roots go down into the soil that the cabbage or cauliflower never reached, though potash, lime sulphates and phosphates are as much needed for the cabbage as for carrots and parsnips.

(2.) Plants of the same natural families should never immediately succeed each other, *e.g.* cauliflower should never succeed cabbages or knolkhol, but should follow crops of potato, peas and beans.

(3.) Lastly, it is very important that a garden should be divided into plots or blocks, and a systematic diary kept of the different crops planted with notes regarding each, for this will enable each gardener to choose a rotation of crops best suited to his land.

The following has been considered by Messrs. Sutton and Company a good cycle of crops for some of the common garden vegetables:—(1) Cabbages, (2) Carrots and Beet, (3) Peas, (4) Celery, (5) Potatoes.

Secondly, great care should be paid to the manuring of the soil. Large quantities of cattle manure or what we may classify as a general manure are used in the gardens in Nuwara Eliya, sometimes very indiscreetly. In the use of cattle manure a great mistake is made in not collecting the fluid excrements of the animal which constitutes an important part of the manure. Great benefit could also be done if our gardeners used special and corrective manures to meet the particular conditions of their soil. Lime has been used successfully, as from chemical experiments tried it has been found very suitable to the soil of Nuwara

Eliya, which is particularly sour and acid in its condition at present. Besides; there are many artificial manures which recommend themselves and have been tried with more or less success, such as basic slag, kainit and nitrate of potash. Too much attention also cannot be paid to obtaining a proper humus—that is to say, the black earthy substance resulting from the decay of vegetation in the soil—as it contains several ingredients necessary to plant life which cannot be obtained in any other way. This can always be obtained by burying the garden refuse, taking care not to bury or turn in any deceased plants or weeds.

It is also important to bear in mind the use of *green manures*, and the planting of catch crops to serve this purpose ought to be experimented on. It will always be found that cabbages planted between rows of peas or any other leguminous plant thrive well, just as in the west of England it is customary to plant celery and peas in alternate lines. This custom is evidently based on the fact that plants belonging to the Natural Order Leguminosae have the power of taking in various amounts of atmospheric nitrogen and building this up into complex compounds in the plant, which pass into the soil thus increasing the percentage of nitrogen in the soil; and it will be very interesting to watch experiments on different crops planted in between these "nitrogen collectors" as they have been called. The famous green manure which is being used to some extent among tea is the "Crotalaria striata" which ought to grow in Nuwara Eliya, and some experiments may be made with the "Crotalaria Walkeri," an allied species, which grows wild in Nuwara Eliya.

Thirdly, it should be deemed essential if possible to let your land or even a portion of your land lie fallow for some time. For this purpose the land should be dug and trenched, and if necessary sown with some fallow crop suitable for the purpose. It has been found by a well-known gardener in Nuwara Eliya that cabbages thrive on land which has lain fallow for some time, and that this is one of the most efficient methods of getting rid of Club-root. There is nothing that promotes the fertility of the soil so much as affording the natural influences of rain and sun full opportunity in liberating the constituents that are locked up in it. If a block of land is left fallow during a south-west monsoon it ought to be greatly benefitted and give a much better crop. But one difficulty offers itself to our gardeners in Nuwara Eliya in this respect, and that is the want of space to carry out anything like a proper system of rotation of crops or even of allowing their land to lie fallow for a short time. The gardens in Nuwara Eliya except a few, consist of a few roods, and it will not pay the cultivator to allow them to lie fallow even for a short time. In this connection it may be mentioned that there is suitable Government land which may be taken up by enterprising cultivators should Government be ready to offer any encouragement to them.

The last four or five years have also seen the growth of club root in cabbage, cauliflowers and turnips, which has practically prevented the successful growth of cabbages and cauliflower in the town where special care and other preventive measures have not been taken. This disease has been known in Europe for over a century, where it has various names besides club root, evidently given to it from the clubbed or club-like appearance of the roots, such as "anbury," "botch," "finger and toe," "hernia or rupture."

A general lack of vigour in the plant showing itself by its parched yellow drooping leaves and stunted growth, and subsequently the death of the plant itself indicates the disease. On pulling the plant one generally finds that instead of having a good well-developed main root with a good number of rootlets, we have a swollen mass, which is either compact or broken up into numerous irregular swellings of a whitish or dirty white appearance. These swellings sometimes attain to the size of one's fist, becoming larger on the main root than on the side roots.

Different causes were assigned for this disease. At first farmers thought that the disease was caused by some insect depositing its larvæ in the root, which produce a swelling which was then called a root gall, but this theory was eventually discarded. Then it was generally accepted that the "clubbing" or swelling of the roots was due to a degeneration of the plant affected, what was known as a "sporting" condition when the plant reverted to a considerable extent to its original wild form. But this theory would not apply to every case, as the disease was found sometimes where the most approved system of cultivation had been adopted and observed so as to prevent any degeneracy or reversion to an original type. To a Russian Botanist, Woronin, we owe the discovery of the true cause of clubbing. In 1876 he found out that the disease is due to a parasitic fungus belonging to the group of Myxomycetes, or slime fungi, so called because they differ essentially from ordinary fungi in consisting of a naked moving mass of protoplasm or cell matter technically known as a *plasmodium*, hence its discoverer gave it the name of "*Plasmodiphora brassicæ.*" But let us remember it as club root. It is interesting and very useful to know something of the nature and life history of this fungus, especially as it will better enable us to take measures to prevent the disease. The jelly-like substance or mass of protoplasm, which is a living substance, takes possession of the root cells of the plant, makes its way from cell to cell absorbing the contents of each cell and naturally feeding on the nourishment of the plant itself, and causing the cells of the root to enlarge and present the club-like appearance so common in the disease. Subsequently this mass breaks up into a number of *spores* which are all reproductive bodies, on which the propagation of the fungus depends, and which spores are let out into the soil in myriads on the decaying of the root in which they have been contained to germinate in the next crop sown. These spores want moisture for their germination, which when present enables the contents to burst through, leaving the seed case behind. The living spore is able to move about by means of a delicate thread-like piece called a "cilium" or hair, and then gets the name of a "*zoospore.*" Coming in contact with a tender root of a suitable host plant or a plant on which it can feed, it finds its way inside most probably through the root hairs, and there the process of enlargement at the expense of the plant is repeated with its dire results. The plasmodium or club root fungus thrives on the food of its host plant. It is a real parasite and in the end kills its host. All parasitic fungi live at the expense of certain other plants which are known as host plants, and it is important to recognise the host plants of this parasite, as we could by keeping a garden clear of the host plants which are weeds and of no use to us but are needful for the support of this parasite, in a great way prevent the spread of this disease. As far as is known, this fungus only attacks or uses as its host, plants belonging to the Natural Order Cruciferæ, such as cabbage, cauliflower and knol-khol among cultivated plants, and the shepherd's purse and hedge mustard among the common garden weeds.

It only remains for us now to see what remedies have been suggested and could be offered for the prevention and cure for this disease.

(1.) From the easy manner in which the spores are propagated it is but evident that the first preventative is to get rid of all diseased plants, a source of future infection. The diseased stumps of infected plants should never be left to rot in the soil or be ploughed or turned into the soil as manure, or added to the manure heap, but should be removed and burnt, or at least taken away as far as possible from the garden.

(2.) We should starve out the fungus by not giving it its host plants to feed on. On a plot of ground affected by the disease alternate crops should be tried and plants introduced on which the fungus does not grow, such as potatoes, beans, lettuce, peas, etc., and on a plot on which the disease has been very severe it is best to plant crops other than cruciferous for two or more seasons.

(3.) We should pay attention to the proper rotation of crops, as it has been found that planting the same crop too often encourages the disease, the disease being spread by means of spores in the soil.

(4.) We should be careful to weed and keep our crops clean, especially from cruciferous weeds which will only help to propagate the disease.

(5.) Try if possible to let the infected plot lie fallow but clear of weeds; this remedy seldom fails to put an end to the disease.

(6.) Isolate the plot affected with the disease as it is very easily spread. In fact, treat the plot infected like some spot infected with some infectious disease. The infected soil can be easily carried to uninfected land by tools, cart wheels and in numerous other ways.

(7.) Be careful to pay great attention to the seed bed. Watch the young plants, removing any infected so as to get healthy plants. Some fungicide may be used preparatory to sowing, as sulphate of copper or Bordeaux mixture.

Among particular remedies found suitable, dressing the soil with recently slaked lime at the rate of 35 to 75 bushels per acre, considerably reduces if not prevents the disease, as it has been found that club root seldom take place in a soil rich in lime. This has been proved a useful remedy in Nuwara Eliya.

In passing I do not think it out of place to mention a few other diseases due to fungi which attack cabbages and cauliflower in Australia and Europe, and which happily so far have not been known to our gardeners in Nuwara Eliya. Among *root diseases* should be noted "Black Leg or Foot-rot" *(Phoma brassicæ)*. A plant attacked by this disease is readily recognised. The leaves have a sickly withered look, the stem is shrivelled and the roots become rotten. On being pulled up the underground parts show numerous little black points visible to the naked eye which constitute the fructification of the fungus.

Among *leaf* diseases should be noted White Rust "albugo candida," a sort of mould in the leaves which looks as if the leaves have been sprinkled with *white wash*, (2) Ring Spot *(Sphærella brassicicola)* is shown by circular patches of about ⅜ of an inch in diameter, greenish towards the margin and dirty from towards the centre, covered with minute densely crowded black points; and lastly Putrefactive Mildew *(Peronospora parasitica)* is found on cabbages, cauliflower, turnips, radish and cress, and is seen commonly on the nasturtuim showing itself as a delicate white or greyish mould on the under surface of the leaves, the affected parts usually appearing yellowish and soon becoming dried and withered. This disease is formed by a fungus belonging to the same division as the "potatoe disease fungus." Gardeners in Nuwara Eliya should be on the look out for these diseases, which are sure to appear in time, and promptly send any infected specimens to the Government Mycologist to report on. Lastly, among *insect* pests the Black Grub, or "*Cut-Worm*" as it is known in America has been and is a source of great annoyance to our gardeners. The grub is itself the caterpillar of several different kinds of night flying moths. They carry on their ravages in the night playing havoc among young plants, especially in the seed beds where three-quarters of the plants are very often killed in a single night.

To the Government Entomologist we are indebted for the following remedies and precautions against this pest:—

(1.) Mechanical means of prevention are the surest. These consist of placing a tin cylinder round each young plant until it has outgrown its liability to be attacked. We can make good use of empty jam and condensed-milk tins for this purpose. The cheaper plan is to tie a roll of stout paper loosely round the stem of each plant before placing it in the soil.

(2.) In America destructive poisoned baits are employed. Small bunches of green clover are dipped in a solution of Paris Green and placed among the plants. When the baits are examined each morning many cut worms are found sheltering beneath the clover. Poisoned bran has also been found very effective. Paris Green is well-mixed with bran in a proportion of 1 lb. to a bushel, the bran is then moistened with water and small handfuls placed among the plants. It is found that the cutworm often prefers the bran to the growing plant. Poisoned leaves (mullein) have been found a good bait in America. The common English Mullein (Aaron's Rod) *Verbascum thapsus*, which is thoroughly naturalised in Nuwara Eliya may be tried.

(3.) A heavy dressing of kainit or other alkaline manure is a recognised deterrent against all subterranean grubs.

(4.) Smooth conical holes sunk in beds are sometimes found successful as traps. Caterpillars wandering about at night falling into these pits are unable to climb out. Empty jam tins sunk level with the soil will form good pitfalls.

Among local precautions and remedies which have been tried with success it has been found a good plan to sow your seed with a large quantity of seed of the common mustard. The mustard sprouts up first and the grubs have been found to prefer the mustard and not to attack the good plants so much. After some time when the good plants have outgrown liability to be attacked the mustard is pulled out. Carrots planted in this manner are in a great way saved from this pest. A large dressing of lime on the surface has also been found useful, and our gardeners have for a long time used the chopped up leaves of a wild lobelia *(Lobelia Nocotianifolia)* known to the Sinhalese as "kiri bamboo," owing to the acrid juice given out of its cylindrical stem, and to the Tamils as "poila colla," in that it has a strong smell of tobacco, and which grows abundantly along our streams and our patnas as a successful bait.

LIVE STOCK.

Poultry Notes.

By G. W. Sturgess, M.R.C.V.S.

DISEASES OF POULTRY.

(*Continued.*)

Consumption,—or Avian Tuberculosis, commonly known as "Going Light" amongst fanciers. This disease is closely related to the tuberculosis or consumption in man, and is caused by the Bacillus Tuberculosis. It is common in poultry and attacks all kinds of birds.

The digestive tract is generally affected, probably due to picking up infective material, such as food or water soiled by the dung of diseased birds, or the sputum of human beings. On postmortem examination the liver, spleen and intestines are generally found to be the seat of the principal lesions.

Small white or greyish yellow spots or tubercles like seeds are seen spread over the surface of the organ affected. These may be cheesy or gritty if cut through. They may be found on all the organs and membranes in the abdominal cavity including the oviduct and ovaries. The lymph glands and joints may also be diseased.

Symptoms.—Feebleness, debility, emaciation, loss of appetite, or on the contrary a voracious appetite, the bird eating a great deal which does not seem to do it any good. Usually there is liver derangement and diarrhoea—paleness of the comb and wattles—in general a gradual wasting away.

Treatment is useless and a waste of money. Diseased fowls are unfit for breeding or for food, and the best plan is to destroy them.

Fresh stock should be given better food and healthy surroundings and pure water; close confinement and bad hygienic surroundings are powerful predisposing causes of the disease.

Cramp is more commonly seen in chickens than in older fowls. It is principally due to cold or damp; keeping chickens on a cold cement floor may cause it. It sometimes occurs where chickens are kept too warm and over fed.

Symptoms.—Stiffness and weakness of the legs, which may become so stiff that the bird cannot stand up on its feet and moves along on the hocks. Hens occasionally get cramp in the back and cannot stand.

Treatment.—Hot flannels to the limbs and gentle rubbing and the application of a little turpentine and camphor liniment. Dry earth or dust should be given the birds to stand upon. Internally salicylic acid and Epsom salts may be given twice a day.

The food should be soft with plenty of green food. Attention should be directed to the remainder of the birds and proper air, light, exercise and food given. Runs should be dry. If the attack is at all severe recovery seldom take place.

Crop Bound.—This term indicates a condition in which the crop is overgorged and distended to such an extent as to be incapable of passing on the food it contains.

It may be due to overeating dry grain which swells, but is usually due to irregular feeding and giving a lot of food at one time, or it may be due to some obstruction to the outlet of the crop.

Symptoms.—The condition is easily noticed by the swollen and distended crop and the lassitude of the fowl. There is usually great thirst.

Treatment.—At first a teaspoonful of salad oil may be given and the crop gently manipulated to try and get the food passed on. The bird should be starved a day or two. If it is successful the diet must be carefully regulated for a few days and a tonic may be given with advantage.

If this fails, an operation can be performed and the crop opened and the contents removed. At a point towards the upper part of the crop the feathers should be plucked out and an incision about one inch long made into the crop and the contents gently removed with a small spoon. After removal the little finger well oiled should be passed into the crop and the outlet examined for any obstruction. The crop may then be washed out with warm weak boracic acid solution, and the wound closed by several small independent sutures, using a small curved needle and fine silk. If possible, the lining membrane should be sutured first and the skin afterwards, or the wound may be closed at once, bringing the inner edges of the wound together. Benzoated lard may then be smeared on and the wound left to heal. The fowl should be put into a box and the diet for 3 or 4 days must be soft and limited in quantity, bread damped with milk or soup will answer the purpose. No water should be given until the wound has closed.

Soft or Pendulous Crop.—In this condition instead of being hard and full of food the crop is soft and full of dirty fluid. If the head is held downwards and the crop gently pressed it will flow out through the mouth. This should be done two or three times a day, or the fluid drawn off by a trocar and canula or by a hypodermic syringe and needle.

For some days the bird should be sparingly fed on soft food and very little water given.

Pills composed of gentian, asafoetida garlic, and camphor with small doses of Sulphate of Iron may be given.

Care should be taken that the bird when liberated does not eat or drink too much at once.

(*To be continued.*)

MISCELLANEOUS.

Lessons in Elementary Botany. II.

By J. C. Willis.

THE SHOOT.

This can usually be distinguished from the root in the sprouting seed, the shoot going upwards, the root downwards. The shoot is usually made up of *stem* and *leaves*, and the leaves are borne upon the stem at definite points called the *nodes.* (Pl. I., June *T.A.*) The stem usually branches in the *axils* (or armpits) of the leaves, *i.e.*, the angles between them and the stem; and the branches repeat the structure of the stem, themselves bearing leaves, and branching in their axils. Of course there are also many stems, *e.g.*, those of palms, which do not branch.

The leaves want plenty of light and air, and the object of the stem is to support and spread them out to get these, and to carry water to them from the roots. The average stem grows straight upwards, this being directly towards the brightest light. That light is the main factor in this direction of growth may be seen by placing a plant with the light to one side of it, for instance by putting it in a window, when it will be found that the stem will grow towards the side from which the light comes. The leaves on the other hand tend to place themselves at right angles to the light, as may also be illustrated by putting a plant for some days in a window, when the younger leaves will all arrange themselves to suit the new direction of light.

It will be noticed in this experiment that the old parts of stem and older leaves, which have quite finished growing will not move into new positions—only the still growing portions are able to move.

If a stem be examined it will be found that while on the old parts the leaves are usually at about equal distances apart, as we approach the growing end the leaves get closer and closer together, till at last they are all crowded up in a *bud*, (Pl. I., June *T.A.*) at the tip. Every stem and branch ends in a bud, composed of younger and younger leaves folded closely over one another, with shorter and shorter gaps between them.

The bud must obviously be tender, and requires some protection, otherwise it will be damaged by heat causing excessive evaporation and shrivelling, or by other causes. As a rule the outer sides of the outer leaves of the bud are covered with hairs, or sometimes with wax, or the outer leaves, as in Rhododendron, are mere scales for the sole purpose of protecting the young bud. Sometimes the bud is protected by its position in the shelter of the mature leaves, or by lying close between the stalk of the leaf in whose axil it arises and the main stem, or in other ways. Examine a lot of buds, and see if you can find one which really has no protection to the delicate young inner leaves.

The stems of most plants elongate and must consequently grow in thickness to carry more water that is now required by the increased number of leaves, and to carry the extra weight involved. As it grows, the old green outer skin or bark gets stretched, and presently begins to crack off, being replaced from below by a brown bark, the bark to which the name is usually given. This bark in turn stretches and cracks off, but is continually renewed from below like the skin of the hand. This brown bark as a matter of fact consists of *cork* (the cork of commerce is simply the bark of a Mediterranean species of oak), and as every one knows cork is water-and air-proof. Now the stem, being alive, requires, like all other living

things, to breathe, and cannot do this directly through the cork. Consequently special openings, called *lenticels* (Pl. I., June *T.A.*) appear in the bark. Any young twig with brown bark on it will show these organs; they appear as little pits, usually longer than broad, so far filled up with a brown powder that they project above the general surface. The cork in them, instead of being in a solid mass, is formed in a loose aggregate of fine particles, and the air for respiration can pass between.

The storage of reserve materials is common in stems; these are stored, as in the roots, to enable the plant to grow again after a period of rest. Tall woody stems, as of trees, only store as a rule within themselves, and there is consequently nothing visible to show that they are storing. But small stems often store, and then as a rule swell up.

Sometimes the reserve materials are all stored in the leaves, and we get the peculiar kind of stem called a *bulb* (Pl. I., June *T.A.*) in which all the leaves are swollen out and have ceased to be green. They are generally folded one over another, as in an onion, but sometimes, as in lilies, merely overlap like tiles on the roof of a house. Plants with bulbs usually rest at some period of the year—generally in the drier weather—and vegetate again later. Sometimes the reserves are stored, as in the potato, in *tubers* (Pl. I., June *T.A.*) or swollen portions of the stem, sometimes there is a fleshy creeping underground stem or *rhizome* Pl. I., June *T.A.*). We shall have to speak of these again later.

Literature of Economic Botany and Agriculture. VI.

By J. C. Willis.

Coconuts.—See Gardening Circular I, 5, p. 49.

Considerations sur le caractère halophyte du Cocotier, Rev. Cult. Col. June 1900, p. 75.

Le Cocotier. Do. pp. 182, 362.

Die Oxydasen und Peroxydasen in der Cocos-milch. Bull. Buitenz. VIII.

Coconut Butter. Gard. Chron., Dec. '01, p. 449.

Creation de Cocoteries sur la côte est de Madagascar. Rev. Cult. Col., Feb. '02, p. 65.

Coconuts. Straits Bull., 1902, pp. 226, 227.

Draining Land for Coconut Plantation. Do. 261.

A Coconut Pest. Do. March 1904.

Usages Economiques du Cocotier. Rev. Cult. Col., June 1904, p. 353.

Spraying Coconuts. "*T.A.*," Sept. 1904, p. 148.

Coconuts in India, on the West Coast. "*T.A.*," Dec. 1904, p. 373.

The Coconut Industry of Trinidad. W. I. Bull., June 1905, p. 149.

Bud Rot of the Coconut Palm. Circ. and A. J., R.B.G. Perad. 1906.

Cocos, other Species.—C. eriospatha and C. odorata. Tropenpflanzer, 4, 1900, p. 197.

Coffee; General.—Coffee in Coorg: Cameron in Planting Opin., Mar. 1899, p. 189.

Fertilisation of the Coffee Flower. Queensl. Agr. J., May 1899, p. 376.

Koffiecultuur in Guatemala, F. W. Morren, Amsterdam 1899.

Le Café. Lecomte. Paris 1899.

Fecondation Artificielle des fleurs de Café pour obtenir les hybrides. Rev. Cult. Col., Nov. 1899, p. 278.

Liberian—Arabian hybrid. Ind. Gard. and Pl., Jan. 1900, p. 32.

Coffee Hybrids. Planting Opin., Feb. 1900, p. 103.

Die Produktions Kosten und die Ertrag der Koffie in Sudbrasilien. Prager in Tropenpflanzer, IV. 1900, p. 76.

Le Café, sa Production et sa consommation. Rev. Cult. Col., VI. 1900, p. 107.
In het wild groeiende Koffie boomen op Java. Koorders in Ind. Merc., Apr, 1900, p. 235.
Kaffee. Tropenpflanzer, 4, 1900, p. 181.
La sterilité de certains hybrides des Caféiers. Rev. Cult. Col., VI. 1900, p. 2.
Le caféier d'Arabie aux Antilles. Do. p. 18.
Le Café de Liberia. Do. p. 129.
II Verslag omtrent de Proeftuinen &c. Buitenz. Meded. 38.
La question du café de Nicaragua. Rev. d. Cult. Col., 1900, p. 578.
Die Gattung Coffea und ihre Arten. Frobner. See Just's Jahresbericht 1898, II. p. 18.
See also Just for every year.
Sur un hybride de Café de Libérie et de café d'Arabie obtenu à la Reunion. Rev. d. Cult. Col., 1901, p. 1. Planting Op. 1901, p. 214.
Die Arten der Gattung Coffea. Buitenzorg Bull. p. 8.
Coffea stenophylla. Rev. d. Cult. Col., July 1901, p. 86.
Reports on Experiments &c. Meded. Buitenzorg, p. 51.
Eine neue Kaffee-art aus Deutsch ost-Afrika (C. Schumanniana). Tropenpflanzer, 1902, p. 142.
L'agriculture sur la côte est de Madagascar. Prud'homme, 1901.
Notes préliminaires sur quelques cafés sauvages nouvelles ou peu connus de l'Afrique centrale. Rev. d. Cult. Col., Mai 1903, p. 257.
Nouvelles Cafés de la côte occidentale d'Afrique. Bull. Jard. Col., July 1904, p. 113.
Coffea canephora. Do. p. 117.
In der brasilianischer Kaffee-region. Tropenpflanzer 1904, p. 119.
Eenige Mededeelingen over Coffea robusta. Ind. Merc., Nov. 1905, p. 805.

The Colombo Agri-Horticultural Show.

I have the honour to state that the entries in class VII. (special vegetables) included a good number of specimens, nearly all shown by one or two market gardeners at Nuwara Eliya who got medals at nearly all the shows. There were no specimens of outstanding merit, but most were good.

2. I enclose Mr. Nock's report.

J. C. WILLIS,
Director, Royal Botanic Gardens.

REPORT ON CLASS V. FRUITS, NOS. 1 TO 16.

"All were of excellent quality, especially the mangoes, pineapples, oranges, limes, mangosteens, rambutans, and sapodillas; papaws and jambus were somewhat disappointing. The general opinion seemed to be that there has never before been such a fine display, and the pineapples were much admired. Competition was keen all through, but the Hon'ble Mr. Obeyesekere informed me that it would have been keener still but for the prevalence of illness in the villages throughout the low-country. Among the limes there were three exhibits of good lemons, and I would suggest a separate prize for these at future shows."

J. K. NOCK,
Act. Curator, R. B. G.,

Fruits and Vegetables: Classes V. and VI.

I have the honour to forward herewith my report on the Classes judged by me at the recent Agri-Horticultural Society's Show :—

At this show I arranged the exhibits under Classes V. and VI. (Fruits and Vegetables), and judged the latter in connection with Mr. Henry Perera, Colombo Mudaliyar.

1. Ash pumpkins were good in number and quality.
2. Bottle gourds were below the average.
3. Pumpkins made a satisfactory show.

4. & 5. Snake gourds and bitter gourds were well represented and the specimens really good.

6. Luffas were only fair and should have been much better. They were all of the "acutangula" variety.

7 & 8. Beans, "dwarf" and "long," were very satisfactory.

9. Princess beans, also called four-winged beans and asparagus peas (Psophocarpus) were not shown at all. The variety is one of which the cultivation deserves to be encouraged.

10, 11 & 12. Tomatoes, lettuce, and celery were also wanting, proving that exhibitors had not been growing specially for the show, or they would not have failed to raise these crops.

13. Sweet potatoes included some excellent specimens.

13*a* & 14. Chillies made a very satisfactory exhibit both in number of entries as well as in size and quality. Some very large-sized specimens were disqualified owing to the required number not having been sent in.

15. Cucumbers. Though out of season some fine fruits were shown.
16. Onions, very few entries, but the specimens sent in were good.
17. Yams. The "collections" were few, but decidedly good.
18. Bread-fruits, satisfactory.
19. Brinjals, very satisfactory.

20. Bandakkai, fair; the fault being that the exhibits consisted chiefly of mature fruits unfit for consumption.

21. Ash plantain were disappointing.

22. Best collection from a School Garden. A good collection came from the Hunumulla School, and another from Palugama.

23. Best cooking plantains, very disappointing.

24. Dehiala (Coco yams). There was a satisfactory show of these and good competition.

C. DRIEBERG,
Superintendent of School Gardens.

Live Stock Section Colombo Show, 1906.

1. This section was much better than last yeai when there was little competition.

2. Thirty-two cattle competed in the various classes this year and eleven country-bred horses and ponies.

3. For the Championship classes 10 bulls and 3 horses competed.

G. W. STURGESS,
Govt. Veterinary Surgeon.

Gampola Agri-Horticultural Show.

Though the show, the first held at Gampola was intended principally for the districts of Udapalata, Uda Bulatgama and Kotmale, exhibits from other districts were accepted, Classes VIII, IX, XI and XIII being alone reserved for the above three districts. No exhibits were brought from Kotmale, the villagers of this district preferring to compete at the show at Nuwara Eliya in April.

ATTENDANCE.—The Show was opened by His Excellency the Governor on March 30th at 3 p.m. The weather was dry and favourable. A large number of town residents, as well as a fair number of villagers attended, 112 on the first day and 145 on the second, in addition to the headmen and holders of free passes.

BUILDINGS.—A large maduwa decorated in the Kandyan style was erected by the Ratemahatmeyas of the two divisions for His Excellency the Governor. The two portable iron sheds of the Ceylon Agricultural Society were utilised, and in addition separate sheds were erected for poultry, dairy produce, arts and manufacture, as well as stalls for cattle by the Ratemahatmeya and the minor headmen of Udapalata who worked with commendable zeal.

A noticeable feature of the show was the revival of the ancient game of ankeliya.

CLASS I. FLOWERING PLANTS IN POTS.

EXHIBITS.—It was sad to find that this class was almost empty. There were only three entries, although there were nineteen items for competition. Considering the number of residents in and around Gampola, it is strange that there was no competition in this class. Exhibitors were principally inhabitants of Gampola town.

CLASS II. CUT FLOWERS.

This class, too, was disappointing, though it was not so bad as Class 1. There were seventeen exhibitors, thirty-seven items for competition, and only eleven prizes were awarded. Exhibitors were mainly inhabitants of Gampola.

CLASS III. FERNS AND FOLIAGE PLANTS IN POTS.

The competition in this class was extremely poor. There were only ten exhibitors and six prizes were awarded, although there were nineteen items for competition. With the exception of three villagers all the exhibitors were from Gampola.

CLASS IV. FRUITS, AND CLASS V. VEGETABLES.

These classes were not so disappointing as the previous ones, but they were certainly not what they might have been. There were only sixty-three exhibits in Class IV and forty-two in Class V. The exhibits of fruit and vegetables were not of any high order, but the continued drought of the preceding months naturally affected prejudicially exhibits for this class. In addition to the town people a considerable number of villagers exhibited.

CLASS VI. VEGETABLE AND ESTATE PRODUCTS.

This class was better represented and the competition was more encouraging than that in the previous classes. Some of the items were, however, not competed for. There were only six competitors under item No. 15—Rubber. The competition in this class should have been very much greater as Gampola is in the heart of planting districts and is so advantageously situated as regards transport. Some exhibits in this class were shown by the estates, but the greater portion by the villagers.

CLASS VII. NATIVE PRODUCE.

Although there was some competition in this class, the exhibits did not come up to a high standard, and only fourteen prizes were awarded. There were thirty items for competition, chiefly from the villagers.

CLASS VIII. DAIRY PRODUCE.

Exhibits by estates and villagers, but principally by the townspeople.

CLASS IX. POULTRY.

The competition in this class was poor and only seven prizes were awarded in Class VIII and three in Class IX. The chief exhibits were from the adjacent estates, very few villagers competing.

CLASS X. PRESERVED FRUITS.

The items in this class were fairly competed for. Five prizes were awarded. There were six items for competition, almost all from the town of Gampola.

CLASS XI. MINERALS.

The entries in this class were as might be expected meagre and only one prize was awarded, being for plumbago at Nawalapitiya. A few gems from Pussellawa were shown.

CLASS XII. CATTLE, SHEEP, BUFFALOES AND PIGS.

This was a satisfactory class both in competition and in quality. The exhibits were however all of section B—Native. No horses were exhibited. A gold medal has been given by the Committee for a fine exhibit of a native bull, the medal of the Agricultural Society not being awarded. A large proportion of the exhibits were from the 'Lantern Hill' Estate.

CLASS XIII. ARTS AND MANUFACTURE.

Exhibits in this class were restricted to Udapalata, Uda Bulatgama and Kotmale, in the hope that the craftsmen of these districts would compete. The result was very disappointing, the only silver exhibits shown being of ancient workmanship and very little Udapalata pottery was shown. It appears well nigh impossible in the absence of stimulus from the walauwas for the craftsmen of Udapalata, many of whom are of families renowned in Kandyan times, to shake of their apathy. This class was as usual crowded with the rubbish now in vogue among Kandyans and Lowcountry Sinhalese.

SUMMARY.

On the whole, considering the time of the year—dry weather—it must be admitted that the show was a success, though both in quality and quantity the exhibits of flowers, fruits and vegetables fell far short of what was desired (the paucity of exhibits in these classes being very noticeable). It should also be borne in mind that this was the first show in Gampola. Success in future shows will greatly depend on the interest and competition aroused among producers and cultivators by holding shows at regular and recognised periods and dates.

The wish to exhibit curiosities and abnormal specimens of plants, fruits, manufacture, etc. at public shows is a noticeable feature among the villagers. They cannot be too often told that what is required is the exhibition of the best produce of their gardens, fields, etc.

The bulk of the exhibits came from cultivators and traders. Among the villagers the headmen were conspicuous in their exhibits, but competition would certainly be greater and more general if sufficient interest were aroused, and the villagers gradually made to recognise the advantages of bestirring themselves and taking more personal trouble to grow and exhibit produce from their lands and their cattle.

H. WACE,
Chairman.

H. W. CODRINGTON,
Honorary Secretary.

Uva Agri-Horticultural Show

I have the honour to forward the following report on the Classes I judged in at the Uva Agri-Horticultural Show held at Badulla on 8th instant.

GENERAL.—I regret to state that the show was poor compared with the one held last year, which could have been classed as second only to that held in Nuwara Eliya. This is not at all satisfactory, and I trust a few remarks, now that they are to be published in the "T.A. and Magazine of the C.A.S.," will result in an improvement in the future. The space allotted to each class was quite inadequate; consequently no proper arrangement—so very important in the classes under review—could be undertaken, and exhibits were jumbled together, and not to advantage. Many people, known to be keen gardeners, were asked why they had not exhibited, but had only the feeble reply "I thought someone would be sure to have better." This is not the way to make a show a success, and to a large extent accounts for the poor quality of the exhibits. Quite different to Nuwara Eliya when the usual remark was, "I sent mine just to fill up, and never expected to get a prize." Europeans could help a great deal by sending in anything they have worth exhibiting. A show should not be regarded as a money-grabbing opportunity, but one to demostrate what can be done in each district.

The remarks in my report on the last year's show were apparently unheeded, for there was no improvement in the arrangement of the cut flowers, state of the pot plants, &c. The former were bundled together in a very native way, and the material was not made half as much of as could have been possible. If one quarter of the flowers had occupied the space of the whole, the appearance would have been very different. Little relief was afforded in the way of greenery. Proper show boxes, such as those sent from Hakgala Gardens, cost little and should be used. It seems impossible to convince competitors that arrangement counts for points in judging. The pots staged were mostly very dirty and only three-quarters full of soil. Drainage appeared to be entirely neglected or very poor, and no attempts seem to have been made in most cases to trim the plants up, stake them neatly, &c. One exhibit was disqualified for having apparently been only potted a day or two previously. Most of these matters were pointed out before, and are worthy of attention. The recent drought followed by heavy rains was made much of as an excuse, but cannot account for such defects as these.

To take the classes individually, *Class I.* FRUITS AND VEGETABLES.—Plantains were scarcely up to standard; the winner showed a good number of varieties. Papaws were good. The gold medal for the best collection of ripe and edible fruit was won my Mr. D. H. Kotalawela for a nicely arranged exhibit. Oranges in this class were not up to the usual Badulla quality. It was very disappointing to find no entries for English vegetables, especially as Weligama even was able to make a fair display of these. Tomatoes were fair and of good varieties.

Class II. FRUITS, VEGETABLES AND GRAINS (open only to villagers).—In this class Mr. E. B. Denham assisted in the judging. Of thirty-eight exhibits of oranges, some were very fine, and it was interesting to learn of natives in the district now being able to realise a profit after buying all of good quality and sending them to Colombo for sale. There is no doubt Badulla is one of the best districts in the Island for this fruit, but it is said that the real good kinds are less plentiful than formerly; if this is so, steps should be taken by the local branch of the Society to increase only good varieties by grafting &c. PINEAPPLES.—Only three exhibits against a fine lot last year. The general opinion then was that they would have been better had the show been held in May.

Class IV. GROWING PLANTS.—Nearly all in this class had an uncared for appearance. The fine specimen of *Nephrolepis* exhibited by Mr. Grant was the best exhibit in the show, and an excellent example of how a fern should be grown. For flowering plants no award was made. Mr. J. B. Bandaranayaka staged a large collection of jungle ferns which were named, but incorrectly. Before improved methods are adopted it would be inadvisable to offer more prizes in this class.

Class V. CUT FLOWERS.—In future more space should be given to make this class the attraction it should be. In all the exhibits of wild flowers cultivated garden varieties were noticed. Some of the roses were very fair, but would have been much improved if shown in proper boxes, one or two blooms of each, and named. Dahlias were poor, and there was practically no competition in chrysanthemums and cannas. In this class I would respectfully suggest that more prizes be offered, such as for roses (1) best blooms of yellow, (2) white, (3) red (4) best roses, six different varieties, (5) do. more than six varieties, (6) best gaillardias, (7) best cactus dahlias, (8) best zinnias, (9) best violets, (10) best cut flowers in a box not exceeding 18″ square. This would cause greater competition and insure a better display.

Class IX. SCHOOL GARDEN EXHIBITS.—R. M. Ukkubanda of Welimada took the prize for a good exhibit which included splendid parsnips, cabbages, leeks, carrots, and beetroot. Celery and capsicum should have been better. Attampettia School was rather a poor second.

The following exhibits were staged from the Royal Botanic Gardens, not for competition :—A complete set of the "Circulars and Agricultural Journal of the Royal Botanic Gardens," and a box of dry grains from the Director. Silk-worm cocoons &c. from the Government Entomologist, and seven boxes of cut flowers from the Hakgala Gardens.

A meeting of the Badulla branch of the Agricultural Society was held in the Town Hall on the 9th instant, at which I read a paper on "Propagation of Plants."

J. K. NOCK,
Act. Curator, Peradeniya Gardens.

THE LIVE STOCK SECTION.

Excepting the Native Bull Class, this section was not so good as last year. The following is a comparison of the Entries in 1905 and 1906 :—

	1905. Entries.	1906. Entries.
Best pony bred in Uva	19	6
,, pair of buffaloes bred in Uva ...	5	3
,, native bull	14	15
,, ,, cow (in or out of milk) ...	15	8
,, pair of cart bullocks (native) ...	7	3
,, ,, of Nellore cart bullocks ...	—	—
,, cattle of any other bred	8	5
,, Hackery turn out	2	3
,, Poultry bred in Uva (cock & 2 hens)	9	9
,, Ducks (2)	5	5
,, Geese (2)	1	2
,, Turkeys (2)	2	—
,, Pigeons (2)	6	6
,, Village Poultry (cock & 2 hens) ...	10	7

G. W. STURGESS,
Government Veterinary Surgeon.

THE MINUWANGODA MARKET SHOW.

It was resolved at a meeting of the local Agricultural Society held at Minuwangoda, on 14th January, 1906, under the Presidency of Mr. E. B. Denham, Secretary of the Ceylon Agricultural Society, to hold an exhibition, on 7th April, 1906, of vegetables, yams, fruits, groundnuts, etc., grown in Alut-Kuru Korale North, in the district of Negombo.

The following prizes were offered by the members of the local society :—

(1.) Mr. Walter Dias Bandaranayaka, Mudaliyar, Rs. 20 for the best collection of vegetables. (2.) Mr. J. E. de Silva Suriyabandara, J.P., Rs. 20 for the best collection of vegetables. (3.) Mr. J. F. Jayawardena Vidana Arachchy of Godakaha Palata, Rs. 10 for the 2nd best collection of vegetables. (4.) Mr. Henry Thomas Perera Seneviratna, Notary Public, Rs. 10 for new vegetables which were not grown before in the Korale. (5.) Mr. Abilinu Silva Gunawardena, Notary Public, Rs. 10 for a bushel of groundnuts. (6.) Mr. J. M. P. Samarasekara, Registrar of Marriages, Rs. 5 for the best collection of fruits. (7). Mr. S. D. Lianduru, Inquirer into Crimes, Rs. 10 for the best collection of yams. (8.) Mr. N. H. Diuadasa, Rs. 10 for best mikiri. (9.) Mr. James de Silva Siriwardena, Rs. 5 second prize for mikiri. (10.) Mr. G. D. Valentine Rs. 5 for five pounds of cocoons.

In pursuance of a notice issued by the local society, the show was held on 7th April, 1906, in the King's Coronation Market, at Minuwangoda. From early morning a large number of cultivators of vegetables in the Korale produced different kinds of vegetables, etc., grown by them. Mr. C. Drieberg, the Superintendent of School Gardens, who arrived at Minuwangoda very early in the morning arranged the exhibits with the help of Mr. A. C. Nawaswayam, Secretary of the local society. It was first thought by the Society that it would be a very poor show owing to the continued drought. However, that did not prevent the cultivators from competing for the prizes offered by the local society as an encouragement for vegetable cultivation. By 12 a.m. the market was almost full with fresh vegetable exhibits, which were certified to by the Secretary of the Society as grown in the district. He had examined each exhibit at the request of the Society before removing them from the places where they were grown. As there were a large number of exhibitors, the Society was obliged to divide the prizes, in order to give a prize to each of the best cultivators.

Judging for the prizes commenced at 2 p.m. by Messrs. C. Drieberg, Arnold F. Karunaratna, Inquirer into Crimes, and Wagiswara, Pandit. In the unavoidable absence of Mr. E. B. Denham, whom the local society expected to distribute prizes, Mr. Drieberg was proposed to the chair by Mr. J. E. de Silva Suriyabandara, J. P., President, V. T. At the request of Mr. Drieberg the prizes were distributed by Miss Lilian Suriyabandara, the eldest daughter of the President. The prizes ranging from Rs. 2 to Rs. 20, including gold and silver coins in small well-designed silk bags, were given away to the best cultivators of vegetables, fruits, yams and groundnuts. An artistic certificate with the photograph of the Governor, founder of the Ceylon Agricultural Society, accompanied each prize. Mr. Drieberg addressed the cultivators at length on the advantages and benefits of cultivation.

The Hon'ble Mr. F. R. Ellis, C.M.G., Auditor-General, accompanied by the Atapattu Mudaliyar, Mr. Solomon Seneviratne, J. P., unexpectedly visited the show. The Auditor-General was very satisfied with the vegetable exhibits. It is the intention of the local society to hold a similar exhibition of vegetables, etc., about the beginning of November next, and the Society expects contributions for the prizes from some gentlemen who own extensive coconut estates in the district. We are glad to certify to the fact that this show has encouraged the people of the Korale to

such an extent, that most of them have taken up vegetable cultivation, and the sales of fruits, fresh and good vegetables are daily increasing in the Coronation Market at Minuwangoda. The local society is making arrangementes to hold a Saturday fair in "Ellis Court" at Minuwangoda, which will be opened to the sale of live stock and all commodities of trade on every Saturday from 6 a.m. to 6 p.m.

A list of prize winners at the show is annexed.

WALTER DIAS, *Chairman.*
JOHN E. D'SILVA, *Vice-President.*
A. C. NAMASWAYAN, *Hon. Secretary.*

Minuwangoda, 4th May, 1906.

LIST OF PRIZE WINNERS.

Prizes.	Exhibits.	Names.	Amounts. Rs.	Cts.
1	Vegetables	P. C. Weerasekara	20	00
2	Do.	D. C. Perera	10	00
3	Do.	Arnolis Perera	7	50
4	Do.	P. Migel Perera	5	00
5	Do.	Samuel Perera	3	00
6	Do.	D. P. Wijayasuriya	2	50
7	Do.	M. C. Kura Rajakaruna	2	00
1	New Vegetables	P. C. Weerasekara	5	00
2	Do.	D. C. Perera	5	00
1	Yams	P. C. Weeresekara	5	00
2	Do.	D. C. Perera	5	00
1	Ground Nuts	S. Abilinu Silva	10	00
1	Fruits	P. C. Weerasekara	5	00
1	Me-Kiri	D. P. R. Jayatunge	10	00
2	Do.	D. C. Perera	5	00

(Signed) C. DRIEBERG,
" A. F. KARUNARATNE,
" WAGISWARA,
Judges.

MALAYA DEPARTMENT OF AGRICULTURE: REPORT FOR 1905.

BY J. B. CARRUTHERS.

The first report of the Department of Agriculture of the Federated Malay States, which was initiated in June of last year, must necessarily be of a more prophetic than historical character. Some useful work, however, has been done, and preparations made for future work when the department is fully equipped. My official appointment as Director of Agriculture and Government Botanist, Federated Malay States, began on 1st February, when I was in England, and my time was occupied in visiting the chief rubber manufactories and in getting information from agriculturists, manufacturers and buyers in England and on the Continent. I also purchased such books as are essential in the work of such a department, one of the chief duties of which is to act as a bureau of information on things agricultural and botanical.

SCOPE OF DEPARTMENT.

In the first report of the Agricultural Department of the Federated Malay States, the objects for which such a department exists may be definitely formulated. The programme is a large one, but none of the items should be left out of the activities of such a department, and though the staff of the Department of Agriculture, Federated Malay States, is not at present large enough to fully overtake all the

work lying to hand, yet as far as is possible this is done, and, when an Agricultural Chemist and Entomologist are appointed, still more can be done. Briefly, the functions of the Department are—

(1) The study of various physiological, and pathological botanical questions bearing on the economic plants of the Malay States.

(2) The care of the health of all cultivated plants and constant watch for the earliest signs of any disease, that steps may be at once taken to eradicate it;

(3) The carrying on of experiments in agriculture and horticulture;

(4) The introduction and trial of new economic plants suitable for profitable cultivation and the distribution of seeds and plants of these to those wishing to begin the cultivation;

(5) The giving of advice and information on agricultural, botanical and horticultural questions.

I arrived in Malaya in June and proceeded at once to form plans for the organisation and equipment of the department. Temporary accommodation was found for my offices and laboratory in the Institute for Medical Research, where, by the kindness of the Director, I got a room and laboratory. The distance from Kuala Lumpur unfortunately necessitates loss of some time daily, and hinders planters from making use of the information to be afforded by the department by personal visits. 170 letters of enquiries for advice on matters agricultural and botanical were received during the last six months of the year—135 from planters and others in the Federated Malay States, and 35 from other tropical countries and from Europe and America. Reports on these letters were furnished, and where relating to cases of diseases in plants these were investigated in the field and laboratory and remedial measures recommended. Except in the case of coconut palm diseases, which are energetically looked after by the Inspector of Coconut Trees, Mr. L. C. Brown, all these diseases had to be investigated and reported on by myself, and with various official duties to perform in connection with land applications for planting purposes, and the organisation and supervision of the department, I have been unable to give to this most important part of the work of the department as much time as was needful, and the investigating had necessarily to be curtailed.

CONDITION OF CROPS.

A large proportion of my time has been spent in visiting estates in Perak, Selangor and Negri Zembilan, and inspecting the rubber and other cultivations with a view to prevalence of disease and of investigating the conditions under which they are cultivated. These conditions do not vary in the Federated Malay States to the extent that they do in other tropical agricultural countries, because only the plains and small hills on the plains are at present used for agricultural purposes, and the conditions of rainfall and temperature are approximately the same. Having been engaged during the last six years in investigating the diseases of plants in a tropical country, and devising and carrying out methods of prevention and cure, I am satisfied that the staple cultivations of the Federated Malay States—coconuts, rice, rubber, sugar, tapioca, nipah, etc,—are in a satisfactory condition as regards health and sanitation. No one who is acquainted with plant life expects that any species can be free from parasitic and environmental diseases, and with an increased number of individual plants in any cultivation the danger of infection and contagion is increased.

DISEASE AND ITS PREVENTION: PROTECTIVE JUNGLE BELTS.

The prevention of the spread of disease in large areas of one species of cultivation is of the first importance. At the outset of planting up of rubber in the Federated Malay States steps must be taken to guard as far as can be done by planting or leaving jungle and thus make barriers against the too easy distribution

of parasitic insects and of the spores of fungi which attack living plants. That each estate should itself plant protective belts is, when large yields per acre are so much desired, perhaps too much to expect. Districts, however, can be to some extent divided off. so that the outbreak of disease in one locality may be confined within limits, and plantations in other parts may either be preserved from the evil or at any rate protected for a time, so that the preparations may be made to prevent or combat the attack on its first appearance. I selected an area of about 16 miles long by two wide running from the Buloh river in a south-east direction to the Klang river and adjoining the Sungei Buloh forest reserve. The direction of the prevalent winds is not sufficiently constant in Selangor to make the position of the protective belt in regard to points of the compass important. So much land had already been taken in Klang and Kuala Selangor districts that it was important to at once reserve the belt, and I selected this area chiefly because it included a series of bukits—*i.e.*, small hills—and thus add to the height of the barrier, also because it included the water catchment area for Klang, which will remain in jungle, and adjoined the large forest reserve of Sungei Buloh, which thus forms a continuation eastward of the barrier. I hope to be able to record in future reports the continuation of this policy in other States, where immediate action is not so necessary as comparatively small areas have as yet been alienated for rubber. The value of such protective belts in tropical countries is not sufficiently recognised. In temperate climates the spread of fungus and insect pests is checked by the advent of winter, and even in the warmer months the rate of increase of diseases due to fungus or insect attack is much slower than in tropical countries. In a climate like the Malay Peninsula the conditions for the spread of fungi are almost perfect. Moisture and heat are the essential factors necessary to the germination and growth of spores of fungi, and in Malaya these conditions are present practically all the year round. During the last six years in Ceylon I have been carrying out experiments as to the wind distribution of spores, and had at various elevations and aspects in the planting districts of that island erected experimental "tabernacles"—*i.e.*, jute hessian screens enclosing a space 48 feet by 8 feet broad 9 feet high and open to the sky. These screens were placed at right angles to the prevalent winds and erected on tea fields just after the bushes had been pruned, and before any leaves were produced on any bushes in the field. In Ceylon the winds are approximately north-west and south-east, respectively, during half the year. The appearance of the leaf spot fungi on the leaves of bushes inside the tabernacle and on the windward and leeward sides, respectively, were carefully observed. These experiments showed clearly the value of a mechanical protection from the attacks of wind-borne spores. Other proof of the efficacy of such protective belts can be got from observations of tea, coffee and other crops near to jungle. A case clearly demonstrating this point was given in my annual report in Ceylon for 1901. On the windward side of a narrow strip of jungle at the brow of a hill a field was badly blighted with leaf disease (*Pestalozzia guepini Desm*). A road 25 feet wide had been cut through the jungle, and on the leeward side was a field of tea which, during the south-west monsoon when the wind blew from the unattacked to the blighted field, showed no sign of disease. A short time after the north-east monsoon began to blow the healthy field began to show signs of leaf blight. but only on the bushes near the road through the jungle. On burning a bonfire on the windward side of the jungle the smoke covered, during the half hour it was watched, practically the whole area that contained bushes attacked by leaf disease.

That such a protective jungle belt is a certain safeguard is not claimed, but that it must prevent a large amount of infection is certain. To insects the barrier of jungle would be equally deterrent, and unless the insects acquired a liking for jungle foliage the interposition of a sufficiently thick belt would effectively prevent their reaching rubber or other cultivations on the far side.

ADVICE ON PLANTING MATTERS.

A good deal of work which cannot be detailed in a report has been done in the direction of advising Government as to letting of land, schemes for drainage and roads in planting districts, and other matters in which Government can help the quickly growing rubber industry. Numerous letters of enquiry as to prospects of rubber show that capitalists in England are beginning to be aware of an agricultural industry which promises considerable profit. The planting community have used the department as a bureau of advice both by correspondence and by personal interviews: by this means the knowledge gained both by the failures and successes of the planter is obtained and recorded, and the department is kept in touch with the progress of planting.

FUMES FROM TIN ORE FURNACES.

A matter which has been occupying the attention of the Department of Mines and myself has been the deleterious effects of the fumes caused by roasting of certain tin ores on vegetation and chiefly the injuries caused to cultivated plants. The question has also been considered by the Health Officer in relation to its bearing on the health of men and animals in the vicinity of the furnaces, but that is outside the scope of this report. Some of the ores more recently mined contain large quantities of sulphur and arsenic, and these being driven off in the form of dense white fumes are injurious to a very large number of leaves. Like most poisons in both the animal and vegetable kingdom, these fumes affect different plants variably. Among trees found in the vicinity of furnaces smelting ores with high sulphur and arsenic percentages, the "rain-tree" (*Pithecolobium saman*) is by far the most markedly affected. These trees are entirely defoliated, and though, owing to a change in the direction of the wind, new leaves may be able to exist for a short time, they are soon destroyed, and in the course of time this continual defoliation kills the tree. The roots are unaffected and the tree goes on struggling against the destruction of its leaves. The plants which seem least affected by these fumes are the palms, and some of these can be seen growing and retaining their leaves, though not very vigorous, while the neighgbouring *Pithecolobium saman* and other trees have been killed. In order to gain definite information as to the damage done to cultivated, plants and the conditions necessary to kill the leaves, I have built a model furnace in the grounds of the Medical Institute where the Department of Agriculture is temporarily housed. Tin ores with a high arsenical percentage will be used in this furnace in the first instance to experiment with plants of *Ficus elastica*, "Rambong," *Hevea brasiliensis*, "Para," and other cultivated plants. Directly sufficient accurate data has been obtained, a simple system of pipes will be placed between the furnace and the chimney, and experiments made as to the cubic space needful to condense the arsenic and sulphur. It may not be necessary to extract all the arsenious acid and sulphur from the fumes, if a sufficient proportion is taken away to render the vapours emitted non-injurious to foliage.

ERADICATION OF LALANG.

The question of the most practicable and economical methods of eradicating *Imperata arundinaceae*, "lalang grass," was one of the first things to occupy my attention, and in July I began a series of experiments as to the value of spraying for destroying this weed. A field near the Laboratory was selected, and part of it divided into seven plots, each 1-300th part of an acre. The grass on six of these seven plots, A to F was burnt off; on the seventh, G, it was "chunkled"—*i.e.*, dug over about 6 inches deep. C, a plot in the centre, was taken as a "control" and not in any way treated, the others were sprayed with varying proportions of copper

sulphate or arsenious acid. The results of these experiments show that this method can be used in eradicating the grass at a very much smaller cost than by digging, ploughing or other purely mechanical method. They will be carried on on an extended scale, and figures of cost and results published.

RUBBER.

The acreage alienated for the planting of *Hevea brasiliensis* (Para), and *Ficus elastica* (Rambong), is now about 100,000 acres, practically all Para, only a few acres being the latter tree. Of this 38,000 is already planted, the figures being:—

Under one	... ...	16,000	acres.
1 year old	... ...	6,000	,,
2 ,,	... ...	4,500	,,
3 ,,	... ...	3,000	,,
4 ,,	... ...	2,500	,,
5 ,, and over	... ...	6,000	,,
		38,000	,,

Most of the Para plantations over five years old are planted at 200 trees or more to the acre, some estates having more than 300, but on the more recent clearings, the distance apart is greater, and the average is probably about 175 per acre. The number of rubber trees of all ages in the Federated Malay States is approximately between 6,000,000 and 7,000,000. The cultivation of Para rubber is in its childhood, and though much has already been learnt as to methods of planting, harvesting, and curing, yet still more remains to be discovered before the industry can be considered to be past the experimental stage as regards its methods. The department has made arrangements to take over from the Conservator of Forests an excellent plantation of Hevea trees seven years old adjoining the Public Gardens, and this will be used to carry on a continuous and exhaustive series of investigations and experiments into various questions, physiological and economic, in regard to latex and the best methods for its extraction and preparation.

LABOUR.

One of the most vital points in connection with the progress of the rubber industry is the provision of an adequate supply of labour. Nearly all the land is cleared and drained by Malays or Chinese on contract, the regular service of Tamils or Javanese day labourers is not used until the land is prepared. Land is thus opened and trees planted without the estate having even a tithe of the labour force which will be required when these trees are tapped. At the present time there is an average of one cooly to every two acres planted, and at least double this number will be required when these estates are yielding rubber. The policy of Government helping the introduction of labour into the country from Southern India is a wise one, and has been of great value to the rubber-planting industry, but the need for such a policy is as great if not greater now than previously. The rates of pay for estates coolies are much higher in Malay than in its rival, Ceylon. This is due to various reasons, a chief one being the high wages paid in mines. Taking the value of the dollar and rupee at 2s. 4d. and 1s. 4d. respectively, the Malay pay is on an average 75 per cent. higher than in Ceylon. Coolies on rubber estates are healthy and contented. The lines on nearly all estates are sanitary and well built, and the daily tasks are lighter than in Ceylon. The general health and physique of the Tamil coolies on rubber estates in the Federated Malay States compare favourably with the labour forces on low country estates in Ceylon. There seems to be no reason why when this country is better known in the recruiting districts in Southern India coolies will not be easily induced to come to Malaya in considerable numbers. Any legislation which helps the planter to get a sufficient supply of labour and to keep them healthy and contented is a great gain to the country.

THE FUTURE OF THE RUBBER MARKET.

The last year's production in the Federated Malay States may be estimated at 300,000 lb. The total world's consumption as found in the official statistics of net imports of the seven great rubber-consuming countries,—viz., United States, Germany, Great Britain, France, Belgium, Austria-Hungary and Italy—was 137,530,458 lb., or 61,397 tons. These official figures fall short of the total world's consumption probably as much as 15 or 20 per cent. but if we take these approximate figures we find that the Federated Malay States in 1905 produced 1-200th part of the world's consumption. Taking the area planted in the Federated Malay States on 1st Jan., 1906, at 40,000 acres, this will give us at 100 lb. per acre in 1912 a yield of 4,000,000 lbs., or 1,785 tons, that will be if the consumption remains stationary 1-34th of the total consumption. But the world's consumption, by official statistics, is :

Year.	lb.	tons.
1903	112,860,478 ...	... 50,384
1904	123,817,903 ...	... 55,275
1905	187,330,458 ...	... 61,397

an increase of 10 per cent. roughly per year, so that in 1912 we may expect at the same rate of increased consumption 70 per cent. more than in 1905—*i.e.*, a demand for and perhaps a supply of 232,288,000 lbs, or 103,700 tons, and of that we could only supply 1-58th part. Thus as far as statistics show the price of rubber is not likely to seriously decrease owing to over-production, and very much larger areas will have to be planted before the production is in excess of the demand.

SUGAR.

Sugar cultivation is the only agricultural industry, with perhaps the exception of tapioca, that is decreasing. This is due to various causes. The price of sugar does not give, except to the most enterprising and modern planter, a sufficient profit. The rise of rubber has led a good many sugar planters to transfer portions of their land to the rubber planter or to plant rubber themselves. The ease with which the planting can be done on sugar estates after the sugar canes are cut, and the saving of time in comparison with felling, clearing, draining and planting jungle land, has proved attractive to the rubber planter, whose chief desire with the present market prices of rubber and high values for rubber trees even recently planted is to find the quickest methods of getting plants into the land.

COCONUTS.

This important cultivation with an acreage nearly three times as great as that of rubber, is dealt with fully in the report of the Inspector of Coconut Plantations, Mr. L. C. Brown, whose energetic crusade against the enemies of the coconut palms have been of great value to the States. By personal instruction and encouragement of sanitary cultivation he has raised the standard of cultivation, and native coconut planters are now beginning to see for themselves the value of such methods as the Inspector of Coconut Plantations preaches. The policy of such an appointment with a staff to take care of the health of a staple cultivation is wise and far-seeing, and is in fact an insurance against the failure of an important source of wealth to the country. Though the acreage of coconuts is three times that of rubber, yet, calculating on the high values placed on land already planted in rubber, the total capital value of the latter cultivation in the Federated Malay States is probably a little greater than that of the coconut plantations. Last year the capital value of coconut plantations was greater than any other industry, but rubber planting has increased so rapidly that even though the area of coconuts shows the creditable increase of 10 per cent, *i.e.*, 10,000 acres, the younger industry is in regard to total value the greater.

PADI.

The cultivation of rice in Perak and other rice-growing districts is capable of improvement in methods and results, the rice is healthy and the land suited for its cultivation. The irrigation works when completed will improve the cultivation to a great extent by making it possible to apply water in proper quantities and at the most advantageous times for the growth of the plant. There is good reason to suppose that without extra labour a much larger crop could be obtained per acre by improved methods of selection of seed, sowing, cultivation and harvesting. Future reports of my department will, I hope, be able to record progress in this direction.

OTHER CULTIVATIONS.

Tapioca, nipah palms and sago have had no serious disease, and cultivation of these products has been carried on succesfully and with profit. The two latter cultivations can with advantage be increased, as there are large areas of land which cannot even by the best drainage-schemes become available for rubber, coconuts or other crop that will not grow in swampy land, and are specially suitable for such plants as the nipah and sago palms.

AGRI-HORTICULTURAL SHOWS.

An agricultural show, the third of the annual Agri-Horticultural Shows of the Colony and Federated Malay States, was held in the end of August. A most representative collection of agricultural and horticultural products and native manufactures was the result, and great interest was shown in all the exhibits by numerous visitors. The rubber classes were exceptionally good, and some samples of rubber, as good quality as has ever been produced, were exhibited and judged. The Superintendent, Government Plantations, Perak. showed a fine series of fruit and vegetables from the Hill Gardens, which demonstrated how well many European vegetables will grow at higher elevations if properly cultivated. He also exhibited an interesting collection of rubber samples of both Ficus (Rambong) and Hevea (Para) from Kuala Kangsar. That such shows are of value as instructors of the methods and results of agriculture and horticulture was evident by the care with which many of the exhibits were examined, and by the questions asked of exhibitors and others as to methods of preparation, culture, etc.

EXPERIMENTAL PLANTATIONS, BATU TIGA.

The report of the Superintendent, Experimental Plantations, Batu Tiga, is annexed, and gives an account of the various plants cultivated there. The Para trees, now three years old, have been rather handicapped by the attacks of Termes gestroi and a fungus—a species of Fomes—on their roots. The Camphor plot is interesting and shows that this plant can be grown successfully at low elevations. It is hoped that when the European planter has time to turn his attention away for a short time from rubber, that camphor may become a useful secondary cultivation. The price of camphor is high, and plants three or four years old should yield a very considerable profit.

GOVERNMENT PLANTATIONS, PERAK.

The report of the Superintendent, Government Plantations, Perak, is also annexed. This is a record of excellent work, both in regard to horticulture and floriculture at the Hill Garden where temperate climate plants are reared, and the control of the gardens at Taiping and Kuala Kangsar, where tropical plants are cultivated. The Taiping garden has very greatly improved under the care of Mr. Campbell, and is now one of the most picturesque ornamental gardens in the East.

J. B. CARRUTHERS,

Director of Agriculture and Government Botanist, F.M.S.

Correspondence.

DATURA STRAMONIUM IN ASSAM.

DEAR SIR,—I note your remarks *re* "Stramonium" in the "Tropical Agriculturist" of August, 1905 (page 358). Datura grows in Assam wild and in large quantities, but its cultivation is forbidden by law; it is an excisable article. This was forbidden, I understand, on account of the abuses of the plant by the natives. Can you tell me what the values of the seed and leaves are?

Yours faithfully,

R. C. WHITE.

Silghat, Assam, June 2nd, 1906.

[They contain a virulent poison and are one of the favourite poisons with Eastern natives. The drug is said to be of use in asthma, rheumatism, &c.—ED.]

IPECACUANHA.

SIR,—Alan Walters in his "Palms and Pearls of Ceylon" says:—Of oranges and lemons there is no lack, and *equally common is the Ipecacuanha* (I. Cephaelis from Greek *Cephaele*, a head, because its leaves are disposed in heads), a native of Brazil, with a bright-orange flower. I have in vain tried to find what this is, which according to Mr. Walters is so common.

Is it then the Binkohomba (sans) Kiràta or Bhûnimba used as a febrifuge? It is said to contain all the properties of Ipecacuanha.

I am informed that large quantities of it are gathered in the Moragala and other districts for exportation.

GEO. E. WEERAKOON.

Talangama, 28th June, 1906.

[Perhaps our readers can throw some light on this.—ED.]

THE ROTATION OF CROPS.

DEAR SIR,—The question of a proper rotation of crops in market gardening was lately discussed at a meeting of one of the branches of the Society. As a further contribution to this important subject, I annex a cutting from *The Garden*, (May 19th, 1906) which may prove useful to local market gardeners.

Yours truly,

C. DRIEBERG.

"This is a most important matter for consideration, and a proper system of rotation in cropping should be strictly carried out. Never allow the same kind of vegetable to occupy the same piece of ground two years in succession, except in such cases as asparagus, rhubarb, seakale, &c., which occupy the ground for several seasons. Although the same plot may produce for several years in succession good crops of the same kind, such as onions for instance, by being well and judiciously manured, yet it is not by any means a good practice. In the end the land would become so exhausted that no system of manuring would again fit it for a similar crop until a rigid system of rotation had been practised. Crops, such as cabbages and potatoes, which are of an exhaustive nature, should be relegated to different soil each year. Tap-rooted plants should be succeeded by those having fibrous roots; thus beet, carrots, and parsnips may be followed by the cabbage tribe, which may also succeed beans and peas,

A systematic arrangement of rotation may be easily carried out by making a plan of the garden, dividing it into plots as follows :—

(1.) Potatoes, Onions, Leeks and Celery.

(2.) Beans, Peas, and other quick-growing crops, followed by Cabbage and Turnips.

(3.) Beet, Carrots, and Parsnips, or other tap-rooted plants.

(4.) Asparagus, Seakale, Rhubarb, &c.

(5.) Melon frames, Cucumber frames, and herb beds.

This shows how the garden is cropped the first year. In the following year No. 1 is cropped as No. 2; No. 2 as No. 3; No. 3 as No. 1; and so on, year by year, each crop being located in a different plot annually.

BEEKEEPING IN CEYLON.

Sir,—Since I read my paper on Beekeeping before the Board of Agriculture, much interest has been aroused in the subject both up-country and in and about Colombo, and I can count more than a dozen new recruits to the ranks of local apiarists. The time is, I think, therefore ripe for the Society to take some definite action with a view to encouraging this very important branch—for it is really a branch—of Agriculture, and helping those who have so long helped themselves.

In Colombo we have one gentleman who has expended quite a large sum on his own account, and even he, with a fairly extensive experience, feels that if any appreciable progress is to be looked for in the near future, we must have expert advice and assistance.

As to the advantages of establishing this industry in Ceylon there should be no two opinions, but unfortunately this is not the case, and the majority of members of the Board have not yet come to understand the advantage of bees either to the agriculturist or of beekeeping to the apiarist. Not long ago the Board appointed a Bee Committee to report on the possibilities of developing apiculture in Ceylon. This Committee recommended the introduction of foreign strains of bees (as it was not thought worth while making further efforts to improve our common indigenous honey bee *Apis indica*), and also that the services of an expert should be engaged for a time to start beekeeping on modern lines.

I do not exactly know the fate of this report, which I believe was referred to the Finance Committee, but it is to be presumed that the recommendations were not approved of, owing possibly to the estimated cost of carrying them out being considered too high. In the meantime, one amateur beekeeper in Colombo, and another up-country, have imported bees. The former spared himself no expense, and now has quite a small apiary of foreign bees, chiefly Italians. He is so far very pleased with the results of his enterprise, and co-operating as I have done with him, I share his preference for the trained bees of the West, and his hopes of establishing them here as successfully as has been done in the West Indies. What is now wanted is the practical advice and assistance of a working apiarist (not a lecture or interview with a passing authority on the subject)—a man who can give a few months of his time not only to the study of our indigenous bees, but to instructing amateurs in the handling of bees and in the 101 details, small but essential, with which a successful beekeeper should be familiar.

In the course of correspondence it was found that such a man was available at what may be considered as the minimum cost, owing to the circumstance that he himself is anxious to study the bees of the East. The opportunity is one not to be

missed as a means of developing an industry which, I think, deserves as much recognition and financial support as the attempt to establish silkworm culture. Indeed, looking at the suitability of beekeeping as a home industry for the natives, and the possibilities of making it a remunerative employment, I am inclined to place the former before the latter.

Yours truly,

C. DRIEBERG,

Superintendent of School Gardens.

18th June, 1906.

The Ceylon Board of Agriculture.

The Twentieth Meeting of the Board of Agriculture was held in the Council Chamber on Monday, June 11th, at 12 noon.

His Excellency the Governor presided.

There were present the Hon'ble Messrs. H. L. Crawford, C. T. D. Vigors, P. Arunachalam, S. C. Obeyesekere and Francis Beven, Doctors H. M. Fernando and J. C. Willis, Messrs. Lushington, Gibbon, Sturgess, Herbert Wright, C. Drieberg, Strickland and W. Dunuwille, the Maha Mudaliyar and the Secretary.

As Visitors:—Messrs. J. Whitehead, E. S. W. Senathi Rajah, Walter de Soysa, L. Vaid, W. H. de Silva, Doctors Banaarjee, Sinnetamby, Solomon Fernando, Hallock, Mylvaganam.

BUSINESS DONE.

1. The minutes of the previous meeting were read and confirmed.

2. The Progress Report No. XIX was circulated.

3. A list of new members was read, and they were declared duly elected

4. The Hon'ble Mr. F. Beven proposed. "That this Board desires to place on record its deep sense of the loss which the Ceylon Agricultural Society has sustained by the untimely death of one of its most distinguished members, the Hon'ble Mr. Herbert Wace, C.M.G., who had always willingly placed at its service his varied and valuable experience and shown his generous sympathy with all classes of agriculturists. That a copy of this resolution be sent to Mrs. Wace as an expression of the heartfelt sympathy of the Board with the family in their sore bereavement." Mr. W. D. Gibbon seconded the motion. His Excellency spoke to the motion, which was carried unanimously,—all standing.

5. Mr. E. S. W. Senathi Rajah read a paper entitled "Agricultural Banks for Ceylon." His Excellency the Governor. Mr. Dunuwille, the Hon'ble Mr. P. Arunachalam and Dr. Willis spoke in the discussion which followed.

6. Mr. Drieberg moved to withdraw the motion standing in his name "that the Society invite Mr. John Sutton, Bee-Expert and Adviser to the Department of Agriculture, West Australia, to visit Ceylon and give demonstrations in bee-keeping —the cost of the visit to be met by the Ceylon Agricultural Society—a vote of Rs. 600 to be taken." This was allowed.

7. Mr. Sturgess, Government Veterinary Surgeon, moved that a further vote of Rs. 1,500 be taken by the Society for the continuance of the work of castration of cattle. The Maha Mudaliyar seconded the motion, which was carried unanimously.

8. His Excellency referred to the retirement of Mr. Denham from the post of Secretary.

The meeting adjourned at 1-45 p.m.

Agricultural Society Progress Report. XX.

There are now 1,103 members of the Ceylon Agricultural Society, and 47 Branch Societies. Steps are being taken to form new Societies in Udunuwara and Harispattu of the Central Province.

The following are the dates fixed for Agri-Horticultural Shows:—

Kurunegala	August 23, 24, and 25.
Avisawella	September 7 and 8.
Kegalle	September 21 and 22.
Wellaboda Pattu (Galle) ...	November 16 and 17.
Three Korales and Lower Bulatgama (Market Show) ...	End of August (probably).
Batticaloa...	Early in 1907.

The Hon. Mr. C. T. D. Vigors has been nominated to act as Chairman of the Live Stock Committee of the Board of Agriculture in succession to the late Hon. Mr. H. Wace, C.M.G.,; and Mr. L. W. Booth as Member of the Finance Committee in succession to Mr. H. T. S. Ward.

Mr. A. N. Galbraith, C.C.S., was appointed to succeed Mr. E. B. Denham, C.C.S., as Secretary of the Society, with effect from the 25th June.

Mr. Denham has been nominated a Member of the Board, and of the Live Stock and Agricultural Education and Publications Committees.

A meeting of the Welimada Branch Society was held on the 9th June. There are now 42 members on the roll of this Society. It was decided at the meeting to send an exhibit of beans to the Colombo Agri-Horticultural Show. Papers were read by Mr. D. A. M. Fernando on "Niyanda Fibre," and by Mr. N. P. R. Coorey on "Cotton."

Rotation of Crops on Chena Lands.—The *Mullaittivu* Branch proposes to experiment in the cultivation of chena lands on scientific principles. It is proposed that every applicant for a chena permit for an acre of land be allowed an additional half acre, on the understanding that the latter is cultivated entirely with cotton. A further condition attached to all permits issued this year by the Assistant Government Agent is that the permit-holder shall plant an area of at least 30 feet each way with manioca. Application has also been made by this Society for suggestions as to rotations of crops which might be tried on chena lands.

The *Kegalle* Branch has applied for sixteen of the model Cawnpore ploughs to be imported from India, in addition to the thirty-seven already ordered.

The *Kandy* Branch has been asked to supply two bushels of *Hatial* seed paddy to the Galle district Agricultural Association, for the Wellaboda Pattu Mudaliyar, who is to experiment with this variety in that pattu.

A meeting of the *Nuwara Eliya* Agricultural Society was held on the 11th June, when an interesting paper on "Market Gardening in Nuwara Eliya and some of its Difficulties" was contributed by Mr. C. W. Bartholomeusz. A report received from the Assistant Superintendent of School Gardens regarding a caterpillar pest affecting paddy at Padiyapelella, near Maturata, was read, and it was resolved to adopt the measures suggested by the Government Entomologist as a means of combating the pest. Mr. H. D. Martin has promised to give demonstrations in castration and in ploughing by improved methods at Nildandahena or Harasbedda.

At a Committee Meeting of the *Batticaloa* Branch Society it was decided to appoint one of the trained men for the castration of cattle. It was also resolved to call a general meeting for the 30th June to make preliminary arrangements for an Agri-Horticultural Show to be held early next year.

An Agri-Horticultural Show held under the auspices of the Colombo Agri-Horticultural Society in the Victoria Park was opened by His Excellency the Governor on the 22nd June. The reports of the scientific advisers of the Ceylon Agricultural Society, who acted as judges in the various classes of exhibits, are tabled at to-day's meeting. The following side-shows attracted much attention :—

Exhibit of Forest Produce timber.
Demonstrations in Bee-handling.
,, in Lace-making.
,, in Ginning of Cotton by Machinery.
,, in Manure: Photos showing growth of trees manured and unmanured, &c.

The thanks of the Society are due to the Conservator of Forests for having at their request arranged so complete an exhibit of forest timbers at short notice.

A special feature of the Show was the exhibits of paddy, dry grains, and other native products sent in by Local Societies throughout the Island to compete for the special prize of Rs. 100 or Gold Medal offered by the Ceylon Agricultural Society. Many of the exhibits attained a very high standard of excellence—the collection of paddies sent in by Mr. P. B. Nugawela, Ratemahatmaya of Harispattu, on behalf of the Kandy Branch, being in the opinion of one of the judges the finest he had ever seen. So good were the exhibits that the judges recommended that two Gold Medals be awarded to the Katunayka and the Matale collections; and two Silver Medals to those from Kandy and Jaffna; while the following were Highly Commended :—

Exhibit by Vidane Arachchi of Werakeve, Salpiti Korale.
Do. Mr. Harry Jayawardene, Mudaliyar of Pasdun Korale East, Kalutara District.
Do. Vidane Arachchi of Kamburugamuwa, in the Weligam Korale.
Do. Mr. P. B. Alawatugoda, Ratemahatmaya of Kotmale, representing the Nuwara Eliya Branch.

Exhibit of Bowstring Hemp by Mr. H. J. Perera, junior, of Uda Pussellawa.

Other competitors were :—Kegalla (through Mapitigama Ratemahatmeya), Vavuniya, Telijjawila, Ratnapura, Trincomalee, Gampola, Chilaw, Kurunegala (through Mr. W. D. A. Gunaratne, Muhandiram), Kandaboda Pattu (Matara), Welimada, Nawalapitiya, Kudagama.

Several of the exhibits included more or less complete collections of native agricultural implements. A similar collection of improved Indian implements was received from the Agricultural Munshi of Vizianagram too late for the Colombo Show, but will be exhibited at the Kurunegala Show in August.

A selection from the best of these exhibits has now been handed over to Sir Stanley Bois, Chairman of the Ceylon Committee at the World's Fair, St. Louis, to be despatched to the Imperial Institute to supplement the collection of Ceylon produce on exhibition there.

Experimental Garden.—The garden attached to the Ruwanwella school is now being prepared, and a supply of seeds, forwarded by the Superintendent of School Gardens, was handed to the teacher at the last meeting of the Three Korles and Lower Bulatgama Local Society.

A quantity of Sea Island cotton seed is being imported by the Director, Royal Botanic Gardens, to plant 50 acres in September at Maha-iluppalama.

Seed Paddy.—The Society applied to the Indian authorities for a supply of seed paddy of the variety known in India as the Narikkuruvai. A communication has just been received to the effect that this seed paddy is not available at present, but that it will be possible for the Tanjore District Agricultural Association to arrange to send the seeds next year, if required. Applications will be received from those intending to experiment—to ascertain the probable requirements before ordering a supply for next year. This paddy is reported to be really a *sixty-days* variety, while the variety known as "sixty days" really takes between 80 and 90 days.

Kapok Cotton.—Messrs. J. Whitehead & Co., Maradana, are buying tree (kapok) cotton in any quantities up to 100 tons at ruling prices. Any other kinds of cotton will also be bought by them in any quantity.

Castration of Cattle.—Since the last report the following demonstrations have been given in castration of cattle:—

Southern Province—Bentota, Bogahagoda, Induruwa, Deniyaya; *North-Western Province*—Pellandeniya, Malawapitiya; *Eastern Province*—Trincomalee, Muttur, Toppur, Kilivetti, Tamapalakamam; *Province of Sabaragamuwa*—Ratnapura.

Demonstrations will be held in the Central Province, Province of Sabaragamuwa, Province of Uva, and Southern Province.

Mr. Chas. H. Bagot, of St. Leonard's, Halgran-oya, writes under date 27th June, to thank the Society on behalf of himself and others for having arranged the demonstration held at Halgran-oya by Mr. E. T. Hoole, Assistant Veterinary Surgeon. Some 20 pigs and cattle were successfully castrated on this occasion.

Publications—The Society has obtained two copies of "The Organization of Agriculture" by Pratt. Copies can be secured from Messrs. Cave & Co. A copy is tabled for reference.

The Editors of the "Sihala Samaya" and "Dinakaraprakasa" have kindly sent in 100 copies of two editions, and 50 copies of two editions, respectively, of their papers containing translations of the proceedings of the last meeting of the Board. Copies have been distributed among the Local Branches.

A. N. GALBRAITH,

2nd July, 1906. *Secretary, Ceylon Agricultural Society.*